SOUTH FLORIDA WATER MANAGEMENT DISTRICT

2004 Executive Summary

EVERGLADES Consolidated Report

January 1, 2004

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On behalf of Governor Jeb Bush, I am pleased to announce the remarkable progress achieved in 2003 to restore the River of Grass. Thanks to committed funding, outstanding performance of pollution control programs, and science-based plans for further improvements in water quality, Florida is saving America's Everglades. The *2004 Everglades Consolidated Report* documents our tremendous progress.

In 2003, Florida adopted a stringent, science-based water quality standard of 10 parts per billion for phosphorus in the Everglades. To achieve the stringent standard, the State is treating pollution in water entering the marsh through the largest system of constructed wetlands in the world. Improved farming practices continue to exceed expectations. Together, the treatment marshes and the agricultural programs have removed an impressive 1,400 metric tons of phosphorus that otherwise would have entered the River of Grass.

The State has acquired almost 200,000 acres, including 12,000 acres in 2003, for Everglades restoration projects, nearly one-half of the total needed. Additionally, more than 42,000 acres of state-owned land were donated to the federal government to complete a massive expansion of Everglades National Park.

Since 2000, Florida has invested nearly $800 million and committed another $1.7 billion through the end of the decade to restore water quality and flow in America's Everglades.

Years ahead of schedule, Florida began restoring a more natural flow of water to more than 50,000 acres of wetlands in Southwest Florida, the first construction project of the massive 30-year Comprehensive Everglades Restoration Plan.

Mercury concentrations found in fish and wading birds in the Everglades have dropped by at least 60 percent from a decade ago. The reductions are the result of State and federal efforts that cut mercury emissions from waste incineration by over 90 percent since 1990. Florida's achievement is a model for addressing a complex, multifaceted environmental challenge.

The secret to our success is staying focused on first-rate science, engineering, and management. It is a proven formula. We look forward to keeping this positive momentum as we move into a new and exciting phase of restoration efforts.

Sincerely,

David B. Struhs
Secretary
Florida Department of Environmental Protection

Foreword

The *2004 Everglades Consolidated Report* is the sixth comprehensive report authored jointly by the South Florida Water Management District and the Florida Department of Environmental Protection. This report brings together a year of scientific, engineering, planning, financial, and management efforts by dozens of outstanding professionals. It is prepared to satisfy various annual reporting requirements of the Everglades Forever Act and other state and federal laws.

The diverse information presented in this *2004 Everglades Consolidated Report* continues to document the scientific soundness and strong performance of programs leading to Everglades restoration. With passage of the amended Everglades Forever Act in 2003, this year's report is an important benchmark as Everglades restoration enters a new era. The 2003 legislation set into motion a decade of aggressive projects and activities, detailed in the Long-Term Plan for Achieving Water Quality Goals. Projects in the Long-Term Plan are, in fact, being implemented as this message is written. In close partnership with other agencies, organizations, and stakeholders, the South Florida Water Management District and the Florida Department of Environmental Protection are committed to integrating the many research, planning, regulatory, and construction activities needed for this extensive effort.

In support of Florida's Government-in-the-Sunshine laws, the South Florida Water Management District each year posts a draft version of the Everglades Consolidated Report on the District's Website, http://www.sfwmd.gov, inviting public comment via an interactive WebBoard. A panel of seven independent experts also reviews the document during a special three-day public workshop. The final report can be found on this Website and also on the compact disc inside the back cover of this booklet.

Our agencies are proud of our many achievements over the past decade and are most honored to introduce the *2004 Everglades Consolidated Report* to the public. We are confident that the research, monitoring, analysis, and planning that are documented in the *2004 Everglades Consolidated Report* will continue to support prudent decision making along the path to Everglades restoration.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

FLORIDA

2004 Everglades Consolidated Report: The Bottom Line

Water Quality in the Everglades Protection Area

- The Florida Department of Environmental Protection used extensive research to propose a phosphorus criterion of 10 parts per billion for the Everglades Protection Area (EPA). The Environmental Regulation Commission approved the phosphorus criterion in July 2003; it will become effective following the resolution of rule challenges and approval by the U.S. Environmental Protection Agency.
- The Florida Department of Environmental Protection analyzed deviations (excursions) from water quality criteria for Water Year 2003 (WY2003) and reported that Everglades water quality generally meets state numeric criteria. Overall, patterns seen in water quality constituents for WY2003 were very similar to recent years and varied across regions of the Everglades Protection Area in association with local environmental conditions and water management activities.
- Monitoring of phosphorus throughout the EPA shows that concentrations continued their decline from levels seen during the 2000–2001 drought, decreasing from north to south.
- In general, the combined performance of the Stormwater Treatment Areas (STAs) and agricultural Best Management Practices (BMPs) continues to exceed expectations. These phosphorus control programs have effectively reduced phosphorus concentrations and loads leaving the Everglades Agricultural Area (EAA) so that over 1,400 metric tons of phosphorus have been removed that otherwise would have entered the Everglades.
- From 1994 to 2003, Everglades fish and wading birds have shown a significant decline in mercury levels. Levels in both largemouth bass and great egrets are down by at least 60 percent. Evidence suggests that these positive trends can be traced to major reductions in mercury emissions into Florida's atmosphere since 1990.

- In spite of this progress, mercury levels in largemouth bass in South Florida remain a concern. More information is needed on relationships between phosphorus enrichment, sulfur levels, and mercury bioaccumulation. Studies have shown that sulfur is a major factor in mercury accumulation in aquatic life, while phosphorus levels play a relatively indirect and minor role.
- The District's Everglades Stormwater Program is developing sound water quality improvement strategies for eight tributary basins to the EPA. This program is identifying geographic areas with water quality concerns and cooperating with local governments to implement water quality improvements.
- Information from Basin-Specific Feasibility Studies was used to evaluate alternative combinations of source controls and regional treatment to reduce phosphorus loading from thirteen basins that discharge into the Everglades. The results of these detailed analyses formed the basis for the Long-Term Plan for Achieving Water Quality Goals, adopted by the 2003 Florida legislature as the optimal strategy for achieving the phosphorus criterion in the EPA.
- The Long-Term Plan contains a comprehensive set of projects designed to achieve compliance with the phosphorus criterion in the EPA. These include specific enhancements to the STAs by 2006, expansion of BMP programs to all tributary basins, integration with Comprehensive Everglades Restoration Plan (CERP) projects, continued investigations of additional measures that will improve water quality entering the EPA, and measures to accelerate the recovery of areas that are already impacted within the EPA. The total estimated expenditures through Fiscal Year 2016 for full implementation of the Long-Term Plan are $444 million.

Ecological and Hydrological Needs of the Everglades Protection Area

- Wading bird nesting was very successful in 2003, although activity was down by over 50 percent from the high levels seen in 2002. With about 34,000 nests in South Florida, 2003 was still one of the best nesting years of the last decade. Unfortunately, wood stork nesting success was adversely affected by rains and rising water early in the nesting season.
- Tree islands are a vital part of the Everglades mosaic and yet their development and ecological value are poorly understood. Studies of wildlife and plant communities on tree islands are being used to fill this information gap and to provide indicators of tree island health to be used as performance measures in CERP.
- Vegetation maps are being created with remote sensing to aid in monitoring landscape dynamics in the Everglades. A recently completed mapping effort in Water Conservation Area 2A revealed that the spread of cattail has slowed when compared to the 1991–1995 period. The slower rate of cattail spread appears to be due to phosphorus controls, hydrologic alterations, and marsh fires.
- Satellite imagery is being used to track changes in the landscape pattern of the Everglades, which was once dominated by ridges, wooded islands, and open water sloughs. This baseline information will help guide restoration and track progress as more natural hydrological patterns are restored through CERP.

- The Loxahatchee Impoundment Landscape Assessment, known as LILA, is an ecosystem research facility located in the Arthur R. Marshall Loxahatchee National Wildlife Refuge. LILA is a large-scale experiment on the landscape effects of water flow and will aid in interpreting complex patterns in monitoring data from the EPA.
- Exotic plants and animals are a major threat to Everglades restoration. To address this pressing need, the multimillion dollar Invasive Species Management and Control Project has been initiated under CERP.
- Biological control of the widespread, exotic tree *Melaleuca* is showing promising results. The *Melaleuca* snout beetle, released in 1997, has been observed to reduce flowering by 80 percent in damaged trees. A second biological control insect, a tiny sap-sucking psyllid related to aphids and whiteflies, appears to be spreading and causing significant mortality in *Melaleuca* seedlings.

Performance of Agricultural Best Management Practices

- Best Management Practices continue to reduce phosphorus loads from the Everglades Agricultural Area to a greater extent (35 percent in WY2003) than the 25-percent reduction required by the Everglades Forever Act. The three-year trend ending with WY2003 represents a 57-percent reduction in phosphorus load from the EAA.
- The C-139 basin has been added to the regulatory program with the goal of keeping phosphorus loads at or below baseline levels. For WY2003, the C-139 basin exceeded its limit load by 7 metric tons, and as a result, inspections are required to verify BMP implementation by individual landowners.

RECOVER Tracks Performance of the Comprehensive Everglades Restoration Plan

- The RECOVER (Restoration Coordination and Verification) team is developing an integrative program to measure and report progress toward CERP goals and is applying regional models to guide CERP decision making. A total system ecological model has been created to provide a look at the bigger picture as it evaluates the interactions among sub-regional conceptual models for CERP.
- RECOVER's Monitoring and Assessment Plan, released in 2003, will provide a framework for assessing whether CERP is meeting its goals and objectives. This plan merges existing monitoring programs with CERP informational needs into a regional plan for data gathering.

Performance and Optimization of Stormwater Treatment Areas

- Four of the six Stormwater Treatment Areas were fully operational in Water Year 2003. The STAs again performed very well this year by removing 125 metric tons of phosphorus that would have otherwise entered the EPA. Since the initial STA began operation in 1994, 340 metric tons of phosphorus have been removed from inflows to the Everglades.
- These constructed wetlands are proving to be consistently efficient and resilient in treating stormwater. This year, they removed an average of 63 percent of inflowing phosphorus. While the 125-metric ton load reduction was impressive, higher than anticipated inflows to STA-1W and STA-5 resulted in less than optimal performance. This performance is remarkable in light of the fact that the STAs received significantly greater flows and loads than the long-term values anticipated during their design.
- To sustain and improve STA performance, intensive monitoring is evaluated continuously. New sediment and vegetation sampling will provide consistent information on wetland performance across all STAs, including the dynamics of individual treatment cells.
- Recent studies of dryouts and water conditions in the STAs have confirmed that these systems are resilient when subjected to depth changes and increased phosphorus loads. Analysis of long-term performance confirms the design assumption that STA outflow phosphorus conditions are highly correlated with inflowing phosphorus concentrations and loads.

Advanced Treatment Technologies

- Studies of submerged aquatic vegetation in Florida lakes and rivers indicate that this technology can store phosphorus in sediments on a long-term basis. This additional information confirms that submerged aquatic vegetation in the STAs has the potential for long-term sustained performance.
- To further evaluate both submerged aquatic vegetation and Periphyton-Based Stormwater Treatment Areas, the District is implementing a full-scale, side-by-side demonstration of these technologies in STA-3/4. Continuing refinement and application of these "green" technologies are most likely to improve STA performance; the Long-Term Plan assures that these green technologies will be fully investigated for use in Everglades restoration.

Progress on Other Everglades Programs

- During WY2003, the District continued to acquire lands for Everglades restoration. About 92 percent, or 12,057 acres, of acquired land was earmarked for CERP to improve water quality, quantity, timing, and distribution. These land acquisitions bring the total lands available for CERP to 192,627 acres, representing 48 percent of the land projected to be needed by CERP.
- Recent accomplishments in support of the Lower East Coast Water Supply Plan include adoption of the St. Lucie Estuary and Loxahatchee River Minimum Flows and Levels, adoption of new water-use permitting rules, and implement of other water conservation and water management projects.

CHAPTER 1

Introduction to the 2004 Everglades Consolidated Report

This opening chapter provides the reader with a basic understanding of the governmental, scientific, and legal context behind the *2004 Everglades Consolidated Report*. Each year, the report updates data and findings from Everglades research, monitoring, and restoration activities to satisfy numerous reporting requirements in a single, integrated document. Two annual reports required by the Everglades Forever Act as well as several state and federal reports required by permits from the U.S. Army Corps of Engineers and the Florida Department of Environmental Protection are primary components.

Similar to previous versions, the *2004 Everglades Consolidated Report* was subjected to an intensive review process, including posting the draft report on an interactive WebBoard, three days of public workshops, and peer review by a panel of seven independent experts. This scrutiny ensures that the *2004 Everglades Consolidated Report* communicates the best information available in support of Everglades programs.

Status Summaries and Technical Updates for Everglades Programs

The *2004 Everglades Consolidated Report* provides updates and status summaries on numerous programs related to the Everglades Protection Area. This area contains most of the remnant Everglades and consists of the Water Conservation Areas and Everglades National Park shown on the following page. A vast amount of technical data, much of it from monitoring and research efforts, is compiled and analyzed for the main report. This Executive Summary highlights key findings and describes components of major Everglades programs.

The Everglades Construction Project, mandated by the Everglades Forever Act, includes six Stormwater Treatment Areas covering 47,000 acres. These constructed wetlands will treat nearly 1.4 million acre-feet per year of stormwater runoff, improving the quality of water entering the Everglades Protection Area.

In basins contributing water to the Everglades Protection Area – but outside the Everglades Construction Project – the Everglades Stormwater Program supports water quality improvements to ensure compliance with state water quality standards.

The Everglades Best Management Practices Regulatory Program works in close cooperation with the agricultural industry to reduce phosphorus concentrations in water moving southward from the Everglades Agricultural Area into the Stormwater Treatment Areas and the Everglades Protection Area.

Everglades Restoration is Unique in Scale and Complexity

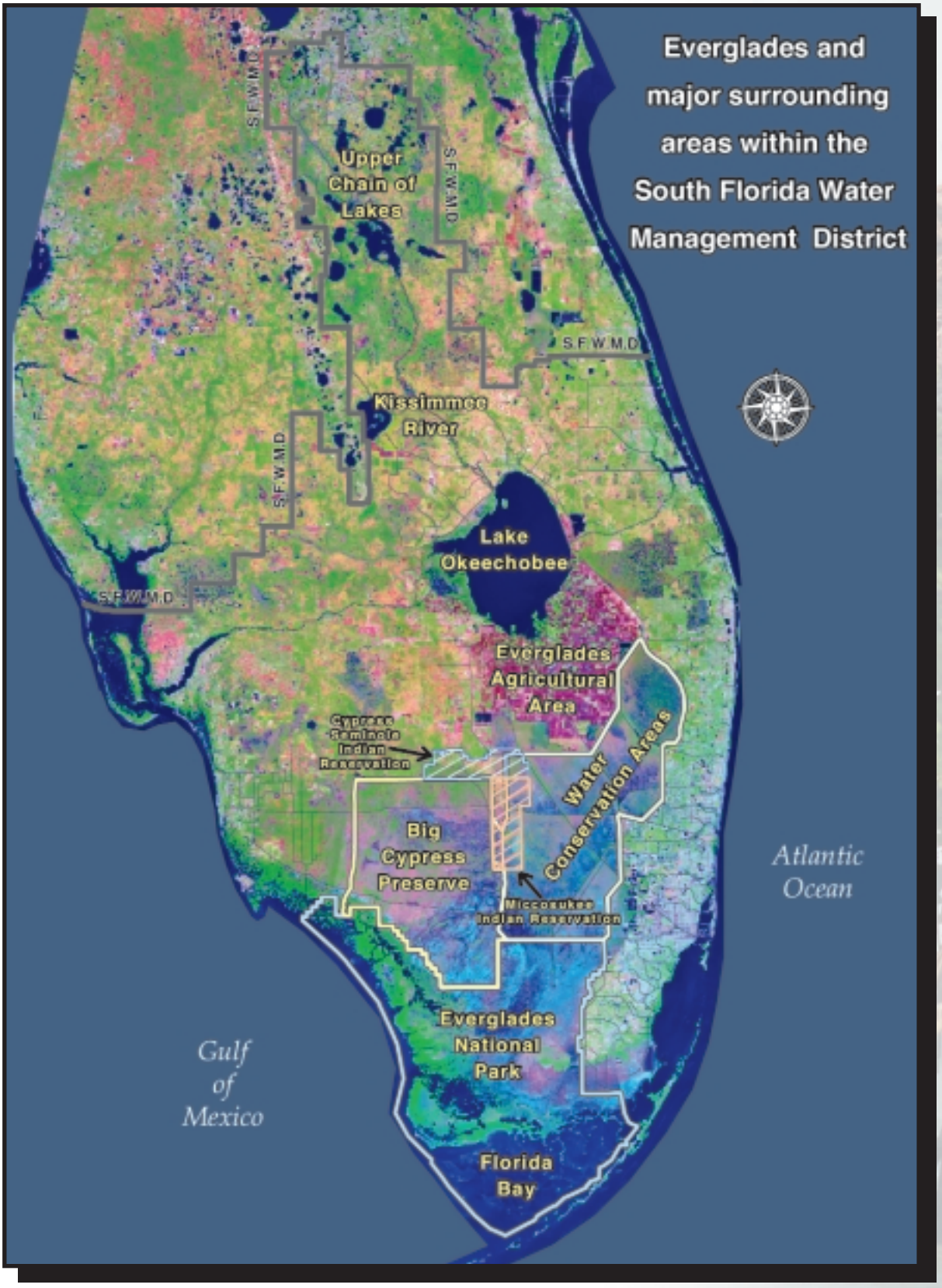
The Florida Everglades has been reduced to about 50 percent of its original extent, and its water supply has been modified dramatically in both quantity and quality. The quality of surface water inflows, particularly regarding the nutrient element phosphorus, is a critical problem. The far-reaching impacts of these stresses, along with strategies for restoring the ecosystem, are evaluated throughout the *2004 Everglades Consolidated Report*.

Everglades restoration is unique in scale and complexity. With an aggressive timeframe and dozens of individual programs, the restoration effort is highly ambitious. Yet the effort is progressing well, and its projects are now being developed and implemented. The *2004 Everglades Consolidated Report* demonstrates that the scientific information base and environmental planning activities for Everglades restoration remain strong. Still, uncertainties remain in the administration, research, funding, and optimization of restoration efforts. The technical information conveyed in this report will contribute to the development of long-term, basin-specific solutions to water quality and quantity problems for all the areas discharging into the Everglades.

Chapter 1 provides an integrative summary of the opportunities and obstacles facing Everglades restoration. This includes an overview of the Everglades restoration strategy, a multifaceted, comprehensive approach that includes interim and long-term plans for achieving water quality goals and for optimizing environmental management. Updates on numerous research and monitoring projects for the current reporting year, known as Water Year 2003 (May 1, 2002 through April 30, 2003), are provided throughout the report.

The *2004 Everglades Consolidated Report* differs from earlier versions in that discussion of the phosphorus criterion development has been deleted, and its chapter (Chapter 5) has been changed to report on the hydrology of the Everglades Protection Area. Chapter 6 now specifically provides information on the ecological effects of altered hydrology. Coverage of the Comprehensive Everglades Restoration Plan (CERP) has been removed from this year's edition, although the report of its Restoration Coordination and Verification (RECOVER) function is retained (Chapter 7).

Major Everglades Areas



CHAPTER 2A

Compliance with Water Quality Criteria in the Everglades Protection Area

Comprehensive water quality monitoring programs in the Everglades Protection Area (EPA) continued during Water Year 2003 (WY2003), the monitoring period from May 1, 2002 through April 30, 2003. The *2004 Everglades Consolidated Report* evaluates conditions affecting water quality in the EPA and assesses water quality parameters that did not meet their state Class III water quality criteria during WY2003. Coverage of water quality conditions for phosphorus and nitrogen in the EPA is presented in Chapter 2C of the *2004 Everglades Consolidated Report*.

Water Quality Parameters in the EPA Generally Remain in Compliance

Most water quality data collected in the EPA continue to meet their state water quality criteria. However, as in previous years, some concentrations exceeded these criteria (identified as "excursions"), with their occurrence varying greatly across different regions of the EPA. Such regional differences are expected considering local environmental conditions and water management activities.

Similar to WY2002, water quality excursions in WY2003 were identified for seven parameters (dissolved oxygen, pH, alkalinity, conductivity, turbidity, total iron, and un-ionized ammonia). Evaluation of these occurrences continues to support the view that localized, natural conditions account for most water quality excursions. Additionally, three pesticides (atrazine, chlorpyrifos ethyl, and diazinon) that do not have constituent-specific Class III water quality criteria were detected at concentrations above their toxicity-based guidelines. These pesticide exceedances occurred at the inflows to all monitoring areas in the EPA except the Arthur R. Marshall Loxahatchee National Wildlife Refuge.

Efforts Continue for Adopting a Site-Specific Criterion for Marsh Oxygen Levels in the EPA

Overall, water quality conditions evaluated for dissolved oxygen (DO) within the EPA during WY2003 were similar to previous monitoring years. The Florida Department of Environmental Protection (FDEP) recognizes that these conditions are natural characteristics of the region and does not consider these excursions to be violations of state water quality standards. For all EPA regions (e.g., Everglades National Park, Water Conservation Area 3) and classes (e.g., inflow, interior), dissolved oxygen was designated as a concern due to ubiquitous concentrations below the current state water quality criterion of 5 milligrams per liter.

The FDEP has developed a site-specific alternative criterion (SSAC) that recognizes the naturally low dissolved oxygen levels characteristic of macrophyte/periphyton-dominated wetlands, such as the Everglades. The specific model and measurement methodology established for the dissolved oxygen SSAC have been proposed for adoption this year.

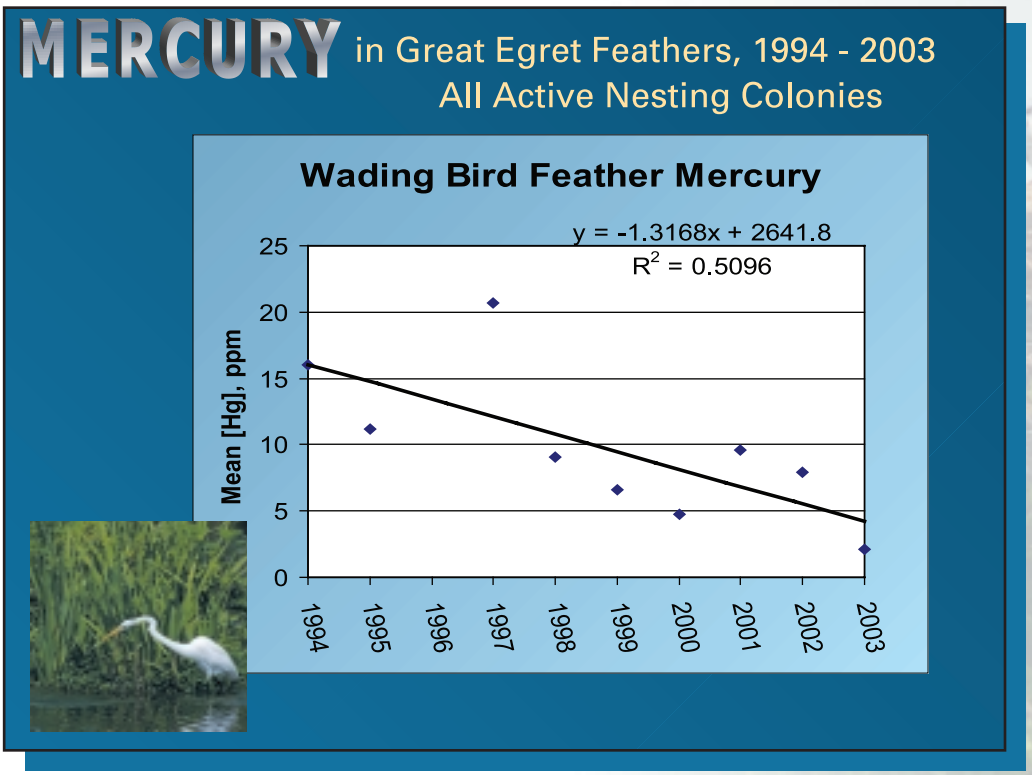
The application of this draft SSAC to surface water data collected in WY2003 resulted in a significant reduction in the number of monitoring stations (from 134 to 26) in which dissolved oxygen was identified as a concern. For most of the remaining 26 monitoring stations, the dissolved oxygen levels are depressed either by increased nutrient levels or groundwater infiltration and are accurately designated as being below natural marsh background levels.

Laboratory analysis supports District water quality monitoring programs

CHAPTER 2B

Mercury Monitoring, Research, and Environmental Assessment

Mercury remains one of the major water quality concerns for the Everglades restoration program; elevated mercury concentrations are responsible for about 1 million acres of the Everglades/Big Cypress being under an advisory for fish consumption. Methylmercury, a highly toxic form of mercury, biomagnifies at each step of the aquatic food chain, such that top predator fish can contain as much as 10,000,000 times more methylmercury than found in the surrounding water. Methylmercury is primarily produced in sediments by naturally occurring, sulfate-reducing bacteria. Its production is controlled by the rate of supply of mercury – atmospherically derived mercury is the predominant source of mercury to the Everglades. The production of methylmercury is also influenced by water quality, with sulfate and sulfide being important factors. Chapter 2B of the *2004 Everglades Consolidated Report* updates the mercury-related findings reported in previous Everglades Consolidated Reports, with supporting data and other technical information on mercury provided in the appendices to this chapter.



Geometric mean concentrations of mercury in great egret chick feathers collected from active Everglades colonies each year, 1994–2003

The South Florida Mercury Science Program Continues to Support Mercury-Related Decisions on Everglades Restoration

The Florida Department of Environmental Protection, with the support of the District, continues to lead the South Florida Mercury Science Program in order to better understand the causes, effects, risks, and potential solutions of the mercury problem in the Everglades. The program seeks to provide scientific information on environmental cycling of mercury at local, regional, and global levels to better support decision making in South Florida. Studies related to this program are now providing a better understanding of why the Everglades is an "at-risk" system for mercury contamination, and what the management options are for the Everglades.

Mercury Levels Continue to Decline in South Florida

The central and southern Everglades support high rates of methylmercury production and biomagnification, and as a result, high mercury levels are found in fish and wildlife. At the apparent peak of mercury levels in Everglades biota in the mid 1990s, concentrations were high enough to pose a risk of chronic toxicity to fish-eating wildlife. Subsequent declines in body burdens have eased this concern, but mercury risk to humans and wildlife remains an important water quality issue.

Everglades fish and wading birds have shown a significant decline in mercury levels over the period from 1994 to 2003. Mercury levels in both largemouth bass and great egrets have dropped by at least 60 percent. Largemouth bass mercury levels from Central Florida lakes have declined by approximately 40 percent, while those in the Everglades National Park have not declined for reasons that remain obscure. Monitoring data suggest that the Everglades has responded to decreased mercury emissions from municipal solid waste and medical waste incineration in South Florida. Levels in largemouth bass, despite substantial declines in recent years, remain well above the proposed 0.3 milligrams per kilogram fish tissue criterion proposed by the U.S. Environmental Protection Agency. Therefore, continued monitoring and research are warranted.

CHAPTER 2C

Status of Phosphorus and Nitrogen in the Everglades Protection Area

As primary nutrients, phosphorus and nitrogen are essential to the existence and growth of aquatic organisms in surface waters. The Everglades ecosystem has evolved as a highly nutrient-poor, phosphorus-limited system, with the natural flora and fauna being adapted to successfully exist under these conditions. Research has shown that relatively small additions of nutrients, especially phosphorus, can have dramatic effects on the biological conditions of the natural ecosystem.

Water quality monitoring of phosphorus and nitrogen in the Everglades Protection Area (EPA) continued during Water Year 2003 (WY2003), the monitoring period from May 1, 2002 through April 30, 2003. Chapter 2C of the *2004 Everglades Consolidated Report* provides an update on the development of a numeric phosphorus criterion for the EPA and presents an overview of the status of phosphorus and nitrogen levels in the surface waters within the EPA.

Phosphorus Criterion Rule is Approved by the Environmental Regulation Commission

Given the importance of phosphorus in controlling natural biological communities, the Florida Department of Environmental Protection (FDEP) has used the results of extensive research to numerically interpret the existing narrative criterion, as directed by the Everglades Forever Act, to propose a total phosphorus (TP) criterion of 10 parts per billion (ppb) for the EPA. The 10-ppb TP criterion rule was approved by the FDEP's Environmental Regulation Commission during a hearing in July 2003. The approved rule has been challenged. It is expected that this criterion will become effective following the resolution of the issues that have been questioned and upon approval by the U.S. Environmental Protection Agency.

Phosphorus Concentrations Continue to Decline in the EPA

The status of the nutrient phosphorus is very important to the ecology of the EPA. The map on the following page summarizes total phosphorus concentrations in surface water (represented as geometric means in parts per billion, or ppb) moving into ("inflow") and within ("interior") the EPA regions for Water Years 2002 and 2003. Overall, the monitoring results for WY2003 show that TP concentrations continued their decline from higher values observed during the 2000–2001 drought (WY2001), decreasing from north to south in the EPA regions, from the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge) to the Everglades National Park (Park).

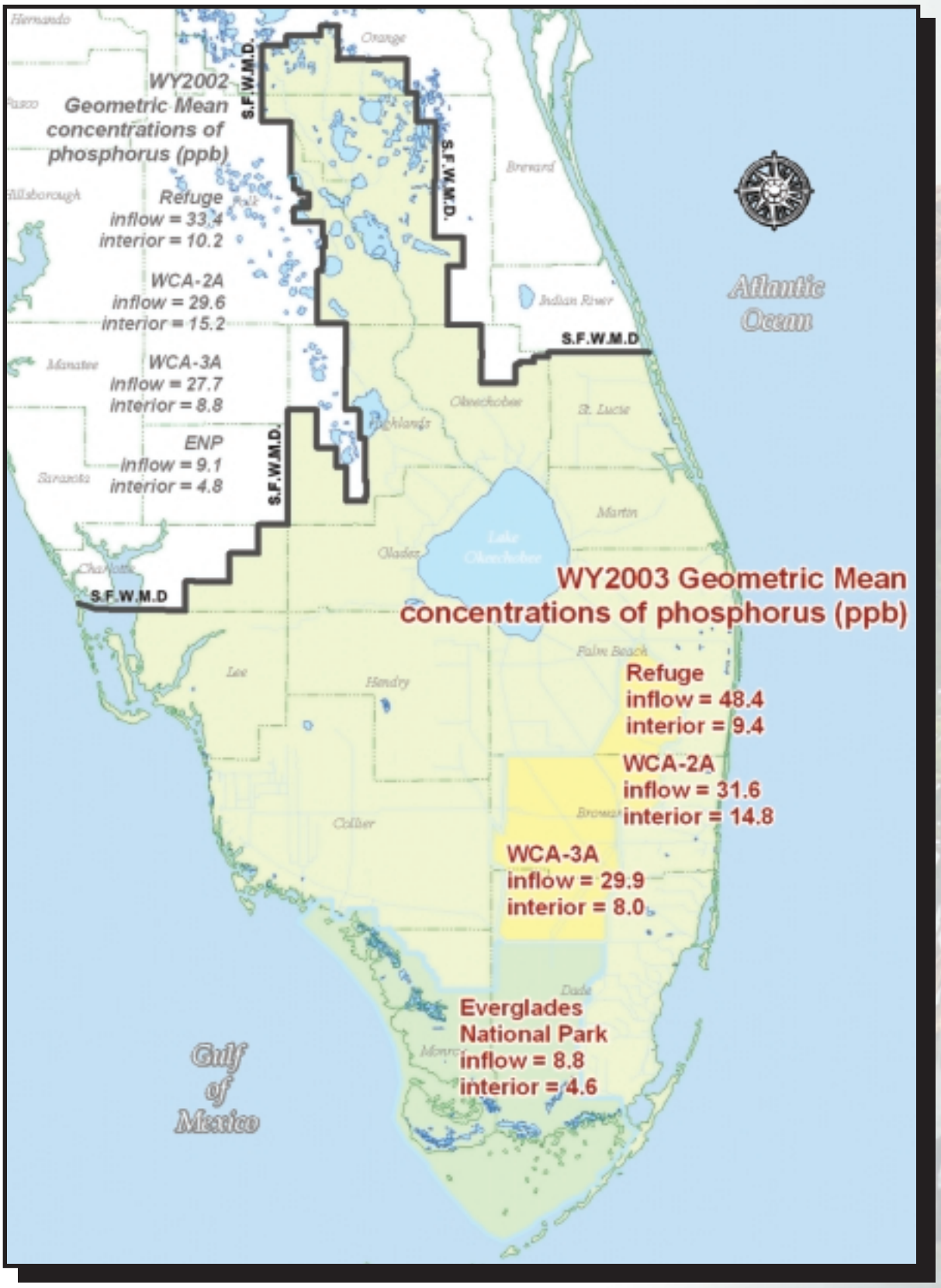
Total phosphorus levels at the inflow stations to all EPA regions of the EPA during WY2003 are below those during the historical monitoring period (WY1978 through WY2001) and are comparable to or slightly above the WY2002 levels. TP levels at the inflow stations to the Park are the lowest recorded for any of the three monitoring periods, with a geometric mean concentration of 8.8 ppb in WY2003 compared to 9.1 ppb in other periods. Similarly, TP levels across the interior marsh stations in all EPA regions for WY2003 are also the lowest recorded compared to previous monitoring periods. Interior marsh geometric mean concentrations ranged from 4.6 ppb in the Park to 14.8 ppb in Water Conservation Area 2. The slightly lower marsh TP levels measured during WY2003 likely reflect more typical rainfall patterns following several drier-than-normal years, changes in water management practices, and a general improvement in nutrient conditions in the marsh.

Nitrogen Levels Show Consistent Trends Throughout the Monitoring Years

In a pattern similar to previous monitoring years, water quality results for WY2003 show that nitrogen concentrations decreased from north to south in the EPA regions. This gradient likely reflects the higher concentrations in agricultural discharges to the northern portions of the EPA, with levels reducing gradually across the marsh as water flows southward. However, nitrogen levels do not decline as much as phosphorus because marsh concentrations are supported by atmospheric inputs.

Nitrogen levels measured during WY2003 were similar to or slightly lower than those measured during WY2002 and the historical period from WY1978 through WY2001 across all EPA regions. The highest average nitrogen concentrations were observed in the inflows to the Refuge and WCA-2, with levels decreasing to a minimum in the Park. During WY2003, mean nitrogen concentrations at inflow stations in the EPA regions ranged from 0.9 to 2.2 parts per million (ppm). Similarly, mean total nitrogen concentrations at the interior marsh stations ranged from 1.1 to 2.1 ppm.

Total Phosphorus Concentrations in the Everglades Protection Area



CHAPTER 3

Performance and Optimization of Agricultural Best Management Practices

Nutrient-rich discharges from the Everglades Agricultural Area (EAA) and the C-139 basin have been identified as contributors to Everglades enrichment. They are the primary focus of the Everglades Regulatory Program and the Everglades Construction Project. Substantial efforts in Best Management Practices (BMP) implementation, research, and education have been directed at reducing phosphorus loading at the source as part of the Everglades Regulatory Program. Chapter 3 of the *2004 Everglades Consolidated Report* provides an update to information on the Best Management Practices presented in previous Everglades Consolidated Reports and supports similar recommendations and conclusions.

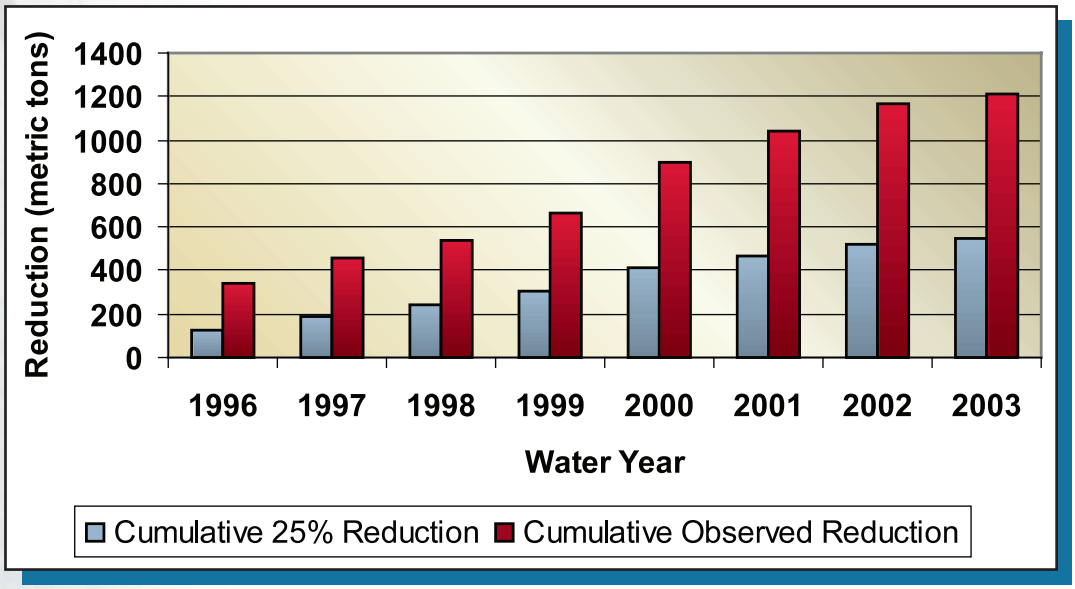
The BMP Regulatory Program Continues to be Effective, Preventing Over 1,200 Metric Tons of Phosphorus from Leaving the Everglades Agricultural Area

Best Management Practices and Stormwater Treatment Areas together are responsible for a declining trend in the phosphorus loads and concentrations attributable to the EAA basin and conveyed to the Everglades Protection Area (EPA). The measured phosphorus load reductions in the basin since BMP implementation in Water Year 1996 (WY1996) compared to the levels measured over the 10-year, pre-BMP base period (October 1, 1978 through September 30, 1988) continue to demonstrate the overall effectiveness of these practices in the EAA. As depicted in the figure below, the BMP Regulatory Program has prevented over 1,200 metric tons of phosphorus from leaving the EAA in water discharges.

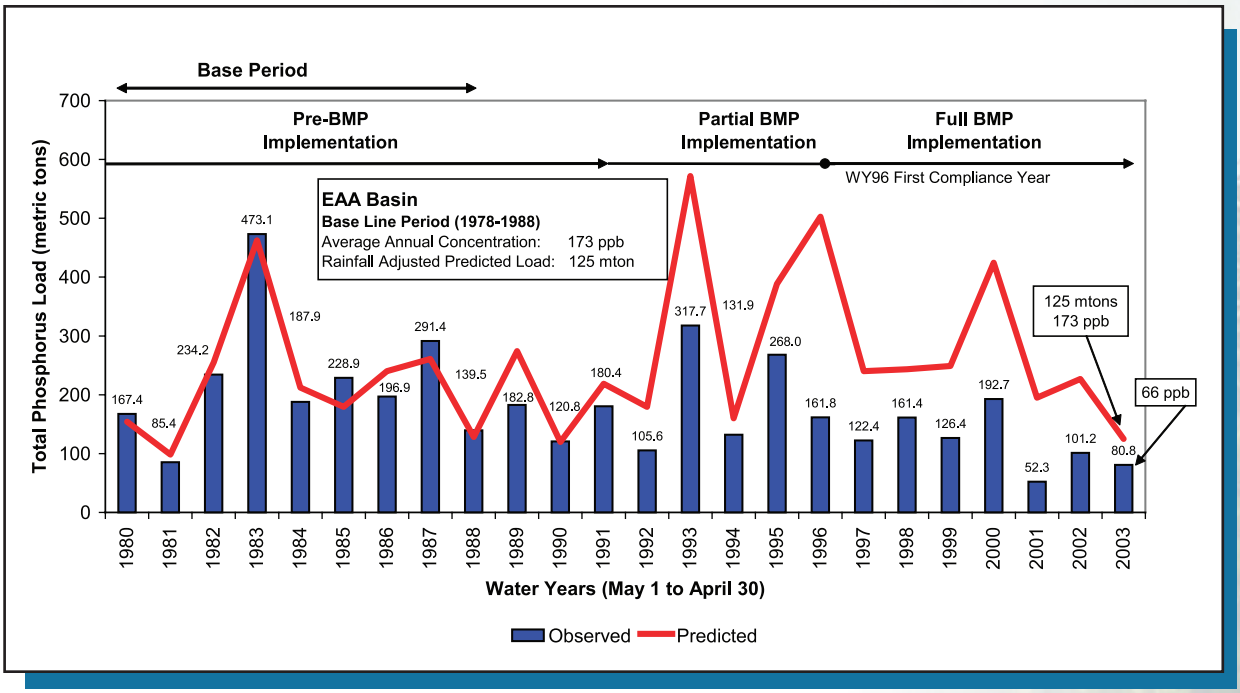
The goal of the BMP Regulatory Program is to achieve a 25-percent reduction in the phosphorus loads from the EAA basin and to maintain the load from the C-139 basin at or below historic levels. This reduction is determined by comparing measured phosphorus discharges from District structures for each 12-month water year (May 1 through April 30) to the base period. In order to account for variability caused by rainfall, the base period phosphorus discharges are adjusted for differences in the amount and distribution of rainfall during Water Year 2003, the current monitoring period from May 1, 2002 through April 30, 2003. The District continues to evaluate the data collected to assess the general trend in phosphorus loads leaving the basins and to determine whether the basins are in compliance with the phosphorus load reduction requirement. Also, ongoing programs of research, education, and testing are continuing to ensure that the long-term performance of BMPs as a phosphorus source control is being maintained or enhanced.

Phosphorus Loads and Concentrations from the Everglades Agricultural Area Continue to Show Declining Trends

As depicted on the figure on the following page, WY2003 represents the eighth consecutive year that the EAA basin has been in compliance since the first year of BMP implementation, in WY1996. The phosphorus load discharged from the EAA basin for WY2003 was 80.8 tons. Importantly, this amount should be compared to the phosphorus load of 125 metric tons that was predicted from the base period (adjusted for rainfall).



Phosphorus load reduction from the Everglades Agricultural Area



Phosphorus loads from the Everglades Agricultural Area, observed and predicted, since 1980

The relative difference between the WY2003 measured tonnage and the predicted base period tonnage (adjusted for rainfall and prior to BMPs) indicates a 35-percent reduction in phosphorus load. The three-year trend ending with WY2003 represents a 57-percent reduction of the phosphorus load from the EAA basin, with a three-year, flow-weighted mean concentration of 69 parts per billion. The latest load reduction continues the trend of consistently exceeding the 25-percent load reduction requirement.

The BMP Regulatory Program has been Recently Amended to Include Phosphorus Monitoring to Determine Compliance in the C-139 Basin

Whereas the BMP program has been implemented in the Everglades Agricultural Area for several years, the Florida Administrative Code (Chapter 40E-63) was recently amended in January 2002 to include a BMP Regulatory Program in the C-139 basin. The goal of the C-139 BMP Regulatory Program is to maintain phosphorus loads at or below historic baseline levels. During the initial compliance period in WY2003, the phosphorus load discharged from the C-139 basin was 77.3 metric tons. This observed phosphorus load slightly exceeds the calculated limit (defined as the limit load, which is 70.3 metric tons for WY2003). Based on this exceedance, the C-139 basin is out of compliance for WY2003. Therefore, inspections are required to verify initial BMP implementation by individual landowners in accordance with their permits. Since the initial permitting and implementation periods followed the rule adoption, the program was not fully implemented during this reporting period. Given these circumstances, the full effects of the Best Management Practices on water quality may not have been fully realized in WY2003. In subsequent Everglades Consolidated Reports, phosphorus loads will be evaluated annually as of April 30 for compliance.

CHAPTER 4A

Stormwater Treatment Area Performance and Compliance

A decade ago, the 1994 Everglades Forever Act set into motion an aggressive and comprehensive restoration program of construction, research, and regulation projects designed to improve the quality of all waters discharging into the Everglades Protection Area (EPA). Large, constructed wetlands, referred to as Stormwater Treatment Areas (STAs), are an important component of this effort.

The STAs are located at key sites along the northern boundary of the EPA. The STAs improve the quality of waters flowing into the EPA by accumulating phosphorus in their sediments through biological and chemical wetland processes. Information pertaining to operations, vegetation dynamics, phosphorus levels, and water quality compliance are evaluated each year for each STA. These data are compared with design objectives and with previous years to assess STA performance. Data on nutrients, dissolved oxygen, pesticides, and mercury also are summarized to document compliance with appropriate conditions of the Everglades Forever Act and the U.S. Environmental Protection Agency's National Pollution Discharge Elimination System permits. Chapter 4A of the 2004 Everglades Consolidated Report presents all of these findings.

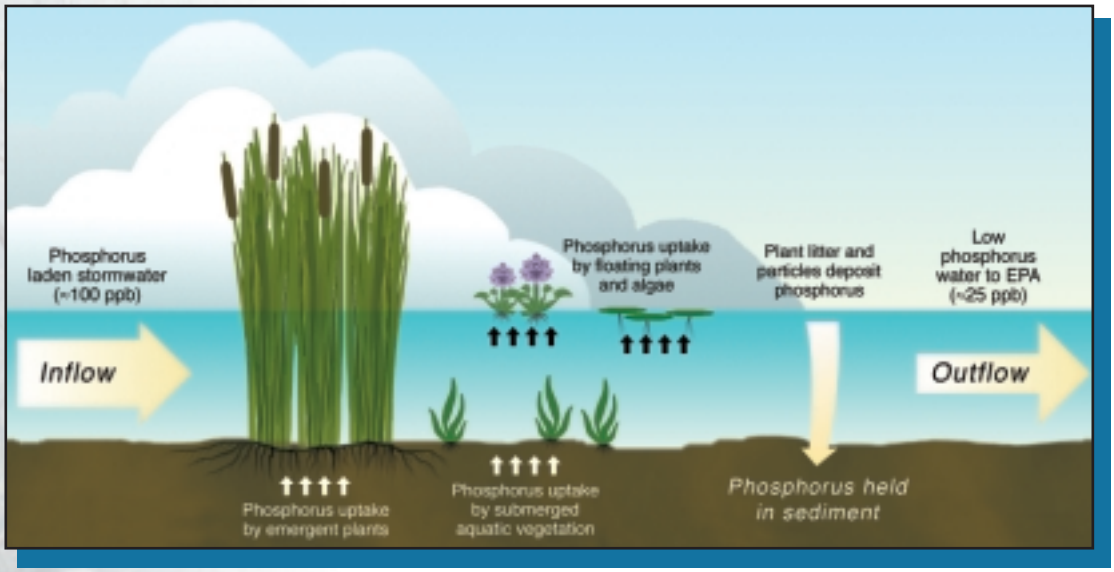
Native sawgrass and fragrant water lily are found throughout the Everglades

STAs Continue to Perform Well

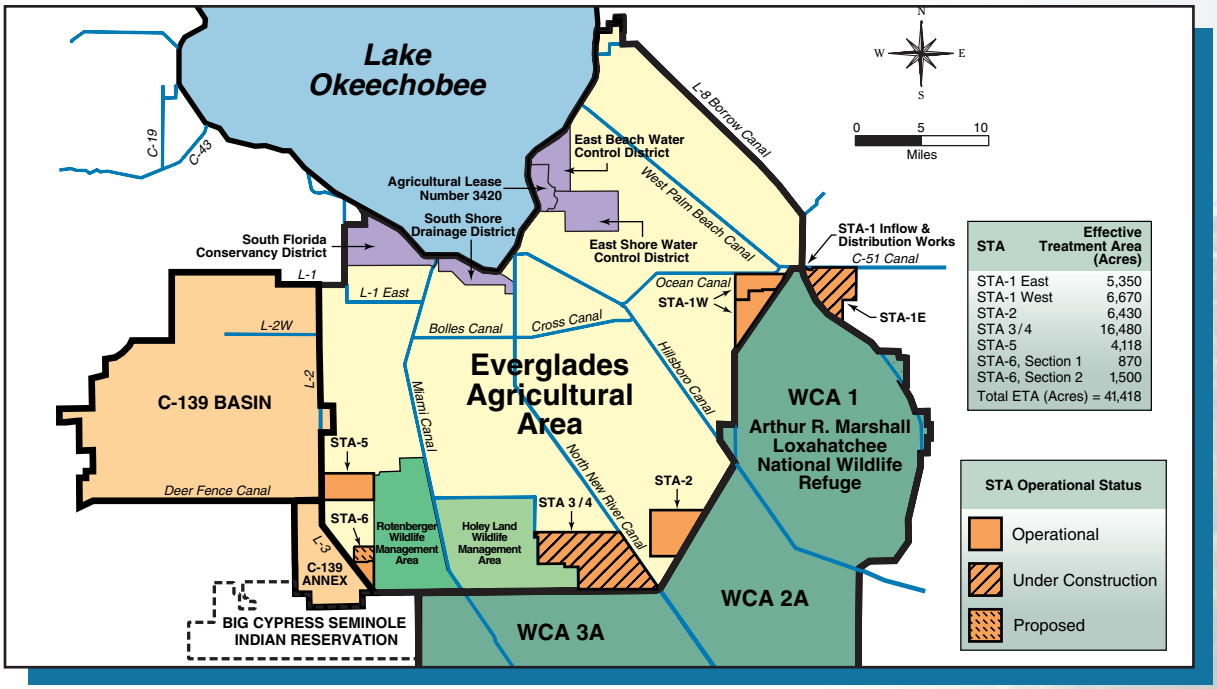
Four of the six STAs are fully operational, and they are in full compliance with state operating permits. During Water Year 2003 (WY2003), which covers the period May 1, 2002 to April 30, 2003, STA-1 West, STA-2, STA-5, and STA-6 Section 1 treated more than 1,358 cubic hectometers (1,101,032 acre-feet) of water and removed more than 125 metric tons of total phosphorus (TP). This resulted in an overall 63-percent removal rate.

During WY2003, the STAs received greater flows and phosphorus loads than the long-term average annual values anticipated during design. Specifically, STA-1 West received about three times the long-term average annual design volume and TP load. As a result, the 12-month flow-weighted discharge concentration

STA Performance



Everglades Construction Projects



increased to 53 parts per billion (ppb), up from 38 ppb in WY2002. Operations for STA-1 West should be within the design ranges within the next 18 months, coinciding with the anticipated full operation of STA-1 East, scheduled for 2005.

STA-2 received about 40 percent more inflow than the long-term average annual design volume. However, lower than expected inflow concentrations resulted in less TP load than anticipated and the outflow averaged 17 ppb. STA-5 received about 60 percent more inflow and phosphorus loading than the long-term average annual design volume. As expected, the 12-month flow-weighted discharge concentration increased to 136 ppb, up from 78 ppb in WY2002.

At STA-6, the inflow pump received about three times the average annual flow used in the design, but STA-6 was not significantly overloaded. This was primarily due to lower than expected inflow TP concentrations. In fact, the WY2003 TP loading was within 25 percent of the long-term average used during design. As a result, STA-6 exhibited approximately 80-percent reduction in TP loads, with an average outlow of 26 ppb.

STAs have Kept Over 300 Metric Tons of Phosphorus from Entering the EPA

To date, the four operational STAs combined have reduced total phosphorus concentrations to about 40 ppb. Since the initiation of STA operation in 1994 through the end of April 2003, the STAs have reduced the total phosphorus load by 340 metric tons, preventing this significant amount of phosphorus from entering the EPA. Best Management Practices (BMPs), described in Chapter 3, have further reduced the amount of phosphorus entering the EPA. Together, the STAs and BMPs have prevented over 1,400 metric tons of phosphorus from entering the Everglades.

Aerial view of STA-1 West showing water management structures G-301 (left) and G-302 (right)

CHAPTER 4B

Stormwater Treatment Area Optimization

The 1994 Everglades Forever Act requires the South Florida Water Management District to build and operate the Stormwater Treatment Areas (STAs) as part of the Everglades restoration. The District also must conduct research that will (1) help to optimize the design and operation of the STAs, and (2) identify other treatment and management methods that may be superior to STA technology. Both of these efforts have the goal of achieving optimum water quality and water quantity for the benefit of the Everglades.

Chapter 4B of the *2004 Everglades Consolidated Report* summarizes the analyses and new findings from the STA Optimization and Advanced Treatment Technologies (ATT) programs that were completed during Water Year 2003 (WY2003) (May 1, 2002 through April 30, 2003). As part of this summary, Chapter 4B provides analyses of long-term trends in STA performance. Detailed performance evaluations of these STAs specifically for WY2003 can be found in Chapter 4A.

During WY2003, a new sediment and vegetation monitoring program was initiated to provide essential information to aid in understanding performance dynamics. This program greatly expands on past monitoring efforts and will provide a database of consistent information across all the STAs. At sampling sites uniformly distributed over the entire wetland, collected data will include interior STA water quality; sediment physicochemical characteristics and accretion; and vegetation community composition, biomass, and tissue nutrient content. In addition, annual water and total phosphorus (TP) mass budgets and flow-weighted TP concentrations will be provided for all treatment cells. To achieve this, the District is installing flow monitoring and automated sample collection equipment at the inflow and outflow of all treatment cells in the operating STAs.

Analyses of long-term performance data from the operating STAs indicate that the flow-weighted mean outflow TP concentration for the operational period of record in each STA was highly correlated with corresponding flow-weighted mean inflow TP concentration and areal TP loading. Treatment performance in STA-2 and STA-6 exceeded expectations predicted by the STA design model in all operational years. STA-1 West did not meet its predicted expectation in the first operational year, but it did so in the following two years. STA-5 had higher outflow TP concentrations than predicted by the model in two of the three years it has been in operation.

Decreased treatment performance in some of the STAs (east and north flow-ways in STA-1 West, STA-5 north flow-way) was attributed to hydraulic overloading and excess phosphorus released after herbicide applications for vegetation management.

Continued monitoring of the STA-1 West test cells indicated that some of the technologies, such as the Periphyton-Based Stormwater Treatment Area (PSTA) and chemical treatment solids separation (CTSS) can reduce outflow TP concentrations to very low levels on a long-term basis. However, none of these technologies as implemented in the test cells consistently reduced outflow TP to 10 parts per billion.

District staff collect water quality samples in STA-1 West

Two studies of other aquatic systems, the Lake Panasoffkee Sediment Study and the Florida Lake and River Survey, indicated that Florida lakes and rivers systems dominated by submerged aquatic vegetation (SAV) can store phosphorus in their sediments on a long-term basis.

Field-scale research of the PSTA technology indicated that while a PSTA system built on a limerock or caprock substrate can reduce outflow TP concentrations, peat-based systems are not effective. Additionally, a PSTA system that maximizes the aspect ratio, which increases the flow path and substantially improves system hydraulics, may provide the best overall TP concentration reduction. To evaluate this further, the South Florida Water Management District has proposed conducting a full-scale, side-by-side demonstration of PSTA and SAV technologies in STA-3/4.

Everglades restoration is now focused on developing biologically based, or "green," technologies to the maximum extent possible. Research has indicated that wetlands dominated by SAV or periphyton (PSTA) have the potential to reach target TP levels on a consistent basis. Available information indicates that improving STA performance may be achieved by reconfiguring the STAs to contain cells dominated by emergent macrophytes followed by cells dominated by SAV and/or PSTA. The Process Development and Engineering component of the District's Conceptual Plan for Achieving Long-Term Water Quality Goals will continue to investigate these green technologies for use in Everglades restoration.

Cattail in the STA-1 West marsh

CHAPTER 5

Hydrology of the Everglades Protection Area

Almost every topic in the *2004 Everglades Consolidated Report* is strongly affected by marsh hydrology. Hydrology is the science dealing with the properties, distribution, and circulation of water on and below the earth's surface and in the atmosphere. Marsh hydrology affects water quality (Chapters 2A, 2B, and 2C), the performance of the Stormwater Treatment Areas (Chapters 4A and 4B), and the research into the ecological effects of altered hydrology (Chapter 6). Because of hydrology's significance to the entire Everglades restoration effort and water management, it is presented as a separate chapter in the *2004 Everglades Consolidated Report*.

No Unusual Hydrologic Events Occurred During Water Year 2003 in the EPA

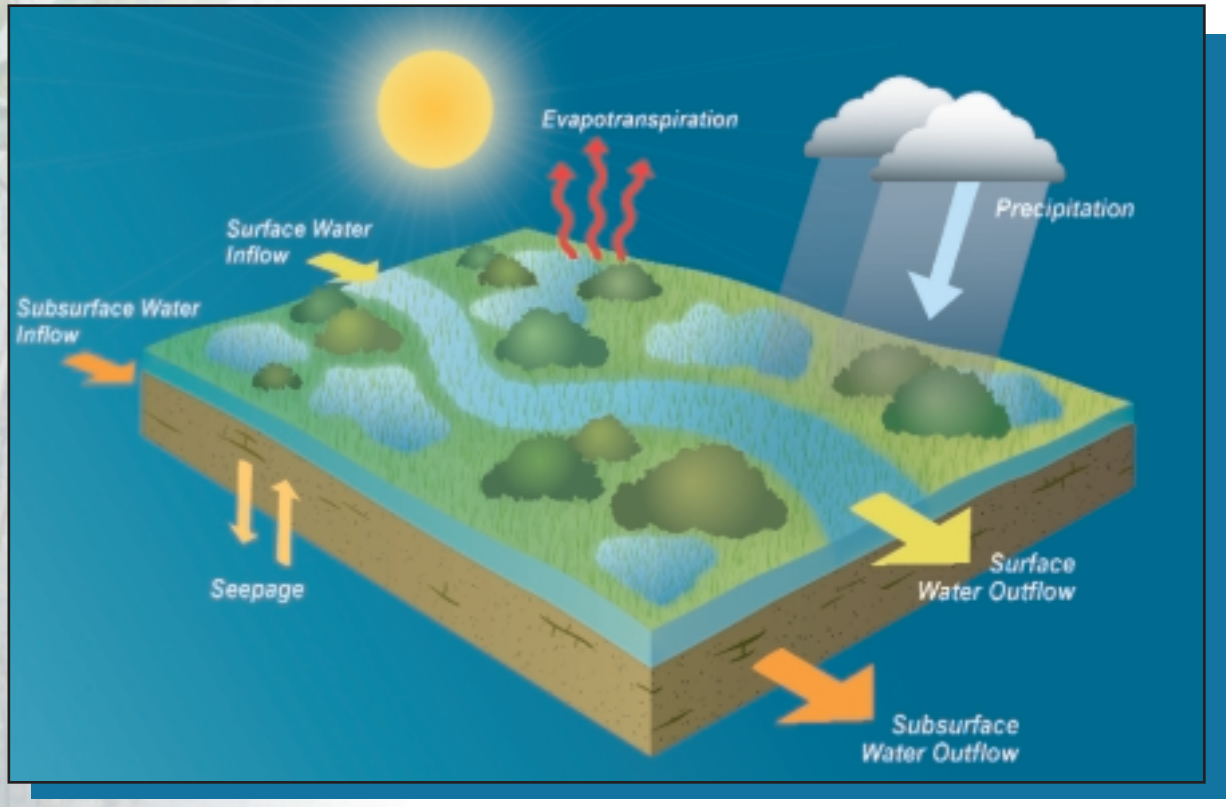
Water Year 2003 (WY2003), the monitoring period from May 1, 2002 through April 30, 2003, was representative of near-normal conditions without any periods of drought or hurricanes. The recent 2000–2001 drought, characterized by significant declines in annual rainfall levels, ended. A minor El Niño event occurred in WY2003. El Niño events are characterized by high rainfall typically occurring in the dry season (November–May), thereby resulting in water level increases. No significant direct effects were observed in the EPA in WY2003.

Monitoring Overall Water Conditions in the Everglades Protection Area is Vital for Restoration and Management

South Florida is a high-rainfall area typically driven by tropical system rainfall events. The annual average rainfall for the entire area managed by the District is 52.8 inches. Rainfall in Water Conservation Areas 1 and 2 was 14 percent below its historical average of 52 inches. Rainfall in Water Conservation Area 3 was close to its historical average of 51.4 inches. Everglades National Park rainfall was slightly higher than its historical average of 55 inches.

In South Florida, evapotranspiration, the process by which water is released to the atmosphere by evaporation from water surfaces and transpiration from plants, is primarily related to solar radiation. Evapotranspiration was close to the expected values during WY2003, estimated as follows: 51.1 inches estimated for Water Conservation Areas 1 and 2, 52.1 inches for Water Conservation Area 3, and 52.6 inches for Everglades National Park. Rainfall and evapotranspiration are the main parameters in the hydrological balance of the EPA; the delicate balance between these two parameters maintains the hydrological system in either a wet or dry condition.

The Hydrologic Cycle



Hydrologic features of the Everglades include brushfires, drought, flooding, and hurricanes

Water levels in the Everglades Protection Area are influenced by several major factors: drought, rainfall, evapotranspiration, seepage, and surface water management. Water levels were generally higher than historical averages in WY2003 except in Water Conservation Area 2A. They tended to follow the annual cycle in water levels seen in historical data in Water Conservation Area 3 and the Everglades National Park. Both inflow and outflow structures throughout the Water Conservation Areas in the EPA are monitored and operated by the District based on regulation schedules and other water management decision factors. Major flows associated with the EPA occurred during the wet season (June 2002–October 2002), while in most cases, the highest flows were observed in July 2002.

Monitoring Network and Database Streamline Multiagency Hydrological Data

The District has developed an intensive hydrologic monitoring network and related database, DBHYDRO. The database stores hydrometeorological data from other agencies, such as the U.S. Geological Survey, U.S. Army Corps of Engineers, National Oceanographic and Atmospheric Administration, Everglades National Park, Florida Forestry Service, Florida Department of Environmental Protection, and others. This database is maintained by the District and serves as an important tool for collecting, storing, and retrieving hydrologic data from various sources in a single location.

CHAPTER 6

Ecological Effects of Hydrology

Drainage of the Everglades changed South Florida from a subtropical wetland to a human-dominated landscape with a strong retirement, tourism, and agricultural economy. In a single century, the Everglades was reduced to half its original size. In the process, water tables dropped, hydroperiods changed, flows were diverted, wetlands impounded, wildlife reduced, water quality degraded, and habitats invaded by nonindigenous plants. All of these impacts were caused directly or indirectly by an altered hydrology.

Research is Essential to Guiding Restoration Efforts

Chapter 6 of the 2004 Everglades Consolidated Report highlights some of the recent research findings and experimental approaches sponsored by the District in studying the ecological effects of this altered hydrology. It can be difficult to show direct cause-and-effect relationships between altered drainage and ecosystem disturbance. A long period of record is required to account for the natural impacts of South Florida's variable climate. In addition, many complex factors are associated with altered hydrology, especially in wetlands as vast as the Everglades. Wetland ecologists around the world recognize that the source, timing, duration, and depth of water in an ecosystem will (1) influence the biogeochemical processes in soils and water, (2) affect the physiological processes of plant growth and decomposition, and (3) impact the reproduction and migration of fauna.

Environmental restoration programs often attempt to redirect succession in an altered ecosystem, moving it when possible toward its unaltered state. This basic theme underlies the Comprehensive Everglades Restoration Plan (CERP), as well as programs initiated under the Everglades Forever Act. It is clear that the decreased extent of the Everglades and surrounding uplands, changes in the soil and topography, presence of exotic species, and the current system of canals and levees all constitute constraints on restoration to pre-drainage (pre-1880) conditions. The challenge facing science and society is to determine which key ecological driving forces will be restored to guide future succession in the remaining Everglades. Research is essential to meet this challenge.

Building a Predictive Understanding of Wildlife Ecology

Current wading bird statistics are drawn from the Annual Wading Bird Report. This report, which is critical for the evaluation of Everglades restoration, is produced through a coordinated effort of the District and eight federal, state, and local agencies. For all wading birds, the year 2003 was characterized by a 51-percent decrease in nesting success compared to 2002, one of the best nesting years in South Florida since the 1940s. The estimated 33,739 nests still made 2003 one of the better nesting years of the last decade. Unfortunately, heavy rains and rising water during the 2003 nesting season had a strongly adverse effect on wood storks. Approximately 70 percent of wood stork nests were abandoned early in the nesting season, between early March and mid-April. Heavy rains continued after mid-April, but only minor abandonment was observed when chicks were older and seemingly less vulnerable to water level reversals.

Wildlife food webs are being studied to determine the role of periphyton as a nutrition source in the Everglades. Increasing the areal extent of native periphyton assemblages is one of the targets and performance measures for CERP, so further investigation is necessary to understand how higher trophic levels are affected. Studies demonstrate that the base of the Everglades food web has yet to be identified, even for the dominant invertebrates and fish. Many of the taxa that consume periphyton appear to select for diatoms and green algae and do not ingest cyanobacteria.

A redbelly turtle photographed with an innovative "camera trapping" technique to document wildlife use of tree islands

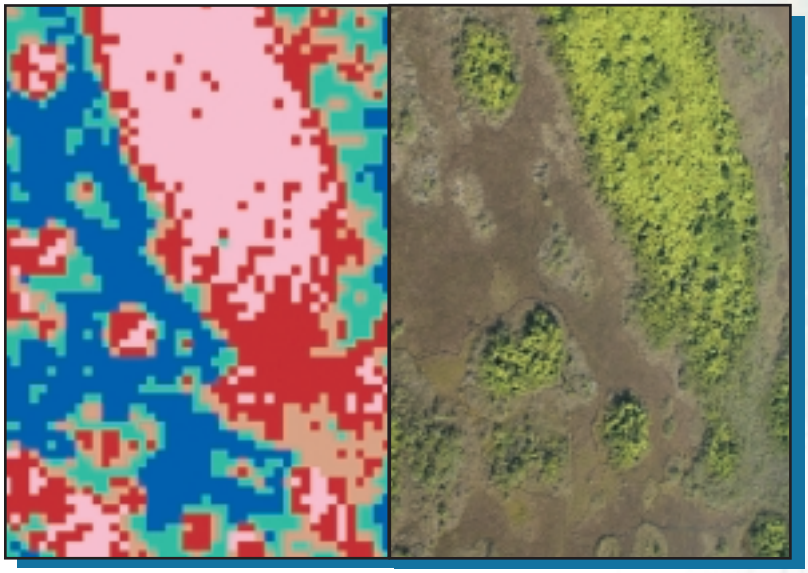
Wildlife on tree islands is poorly understood, and the District has been exploring ways to close this information gap. Included in the *2004 Everglades Consolidated Report* are the design and initial results of a ground surveillance system, known as camera trapping, used to document faunal activity on tree islands. An example of the photographic results is shown on the previous page.

Plant Community Dynamics are the Focus of Ongoing Research

Plant studies are also being carried out on tree islands. In 2002, permanent vegetation plots were established on tree islands to examine how hydrology has shaped the current distribution and abundance of woody tree species in one region of the Everglades Protection Area, Water Conservation Area 3 (WCA-3). Results show that, in general, tree species diversity in WCA-3 tended to be highest on those centrally located tree islands with steep hydrologic gradients from head to tail. Although species richness might be a potentially useful indicator for CERP, it may not provide the best indication of the overall health of a tree island. A better possible indicator of long-term tree island health may be the complexity index (CI), which takes into consideration basal area, stem density, and canopy height, as well as the number of species.

On tree islands, belowground biomass dynamics seem to be influenced by both hydrology and aboveground forest characteristics. The tree islands subjected to the longest hydroperiods proved to have the highest amount of belowground biomass. In contrast, the tree islands with the shortest hydroperiods had the lowest amount of belowground biomass. It is not clear why this occurs. It may be that more roots are needed in the flooded environment to aerate the soil, mine for nutrients, and stabilize the aboveground structure.

In the Rotenberger Wildlife Management Area, hydrologic restoration has led to an increase in hydroperiods and water depths, and to more desirable plant species. However, cattail densities have not been reduced, and the nutrient content of the plant leaves indicates that the high nutrient soils can interfere with hydrologic restoration.



Two IKONOS satellite images representing the same location on the ground. Lime-green areas (right) and pink areas (left) are Lygodium

Plant ecology studies in Florida Bay have been used to create a submerged aquatic vegetation (SAV) model for CERP utilization. These studies indicate that the productivity of an important seagrass, turtlegrass (*Thalassia testudinum*), begins to fall off when salinity rises. While natural variations in rainfall and evaporation rates routinely affect the salinity of Florida Bay, human intervention in the freshwater flow through the Everglades has had a profound impact. In the recent past, high salinity has been observed in the bay – far higher than salinity normally found in the ocean. Furthermore, the *Thalassia* models indicate that elevated salinity coupled with only a slight rise in average water temperature can cause collapse of the seagrass community. These studies will be used to establish Minimum Flows and Levels for Florida Bay and to aid in determining the amount of freshwater flow required for ecosystem health under CERP guidelines.

Vegetation Mapping Provides Information on Cattail and Exotic Species

The District continues to look at the total system, aided by vegetation maps created with specially developed remote sensing and photointerpretation techniques. The *2004 Everglades Consolidated Report* presents new information on cattail changes in WCA-2A and describes the use of IKONOS satellite imagery to detect the spread of Old World climbing fern (*Lygodium microphyllum*). Results show that cattail continues to spread throughout WCA-2A. In addition, sparse cattail continues to spread along distinct cattail-sawgrass boundaries and throughout the southern regions of WCA-2A. However, the rate of spread appears to be slowing down when compared to the 1991–1995 period. This decrease in rate may be due to the reduction in annual total phosphorus loads to WCA-2A during 1995–2003, but it also may be due to hydrologic alterations, invasive habitat availability, and fire.

The Loxahatchee Impoundment Landscape Assessment (LILA), a research facility helping scientists evaluate Everglades restoration projects before they are implemented on a large scale

Remote sensing results for *Lygodium* show that, despite a significant amount of interference from cloud cover and signal interference from cattail, there are 1,431 acres of *Lygodium* within WCA-1. IKONOS imagery may be critical for *Lygodium* control and large-scale evaluations of current conditions throughout the Everglades Protection Area. To illustrate this concept, satellite imagery was used to assess the landscape pattern of the Everglades, once largely dominated by ridges, wooded islands, and open sloughs, all oriented parallel to the direction of pre-drainage water flow. With efforts to restore the ecosystem to a more natural condition, baseline information of these existing ridge and slough landscape patterns — both degraded and intact — is needed. This information will be used to track changes over time as flow is restored and also to provide CERP with quantitative goals for restoration.

Pilot Study Bridges Science and Ecosystem Management

To be successful, Everglades restoration must rely on ongoing research to evaluate progress and to modify projects and programs as needed. The Loxahatchee Impoundment Landscape Assessment (LILA) is a new District ecosystem research facility to provide feedback for this adaptive management approach. Located in the Arthur R. Marshall Loxahatchee Wildlife Refuge (Refuge) headquarters area in Boynton Beach, LILA is designed to experimentally and reproducibly manipulate water flow (both velocity and depth) across a tree island/ridge-slough landscape. Broadly speaking, LILA is a tool for interpreting the complex patterns that come from monitoring biological performance measures in a natural system.

LILA will serve as a pilot study for hydrological regimes proposed under CERP but not yet implemented widely or on a large scale. From a scientific perspective, LILA will act as a bridge between the results of small-scale experiments and large-scale ecosystem management, ensuring that the certainty of data interpretation is high and building high levels of confidence into management decisions for the restoration effort. LILA also has a broad public information function, including self-guided tours for visitors to the Refuge.

CHAPTER 7

RECOVER Activities

RECOVER Provides Technical Information for CERP, Tracking Its Performance and Supporting Adaptive Management

RECOVER (Restoration Coordination and Verification) is a key component of the Comprehensive Everglades Restoration Plan (CERP) program. CERP is the framework and guide for the restoration, protection, and preservation of the South Florida ecosystem. The role of RECOVER is to organize and to apply scientific and technical information to support the goals and purposes of CERP. RECOVER is made up of interagency, interdisciplinary teams sponsored by the U.S. Army Corps of Engineers and the District. (Coverage of CERP has been removed from the *2004 Everglades Consolidated Report* and will be documented separately, although the reporting of its RECOVER function is retained in Chapter 7.)

RECOVER is developing an adaptive management program that will better prepare the CERP to anticipate and respond to future uncertainties. This program will provide information on whether the responses by the systems being restored are matching the restoration objectives. It will also be used to determine when and how implementation of the plan could be improved where the objectives are not being met. The four key principles of adaptive management being incorporated in the CERP program are (1) anticipation, (2) learning, (3) communication, and (4) adjustment. The ultimate role of adaptive management in CERP is to have an ongoing, scientifically based process for substantially increasing the probability that the plan will succeed.

Newly Developed Total System Model Supports the Development and Refinement of Regional Models

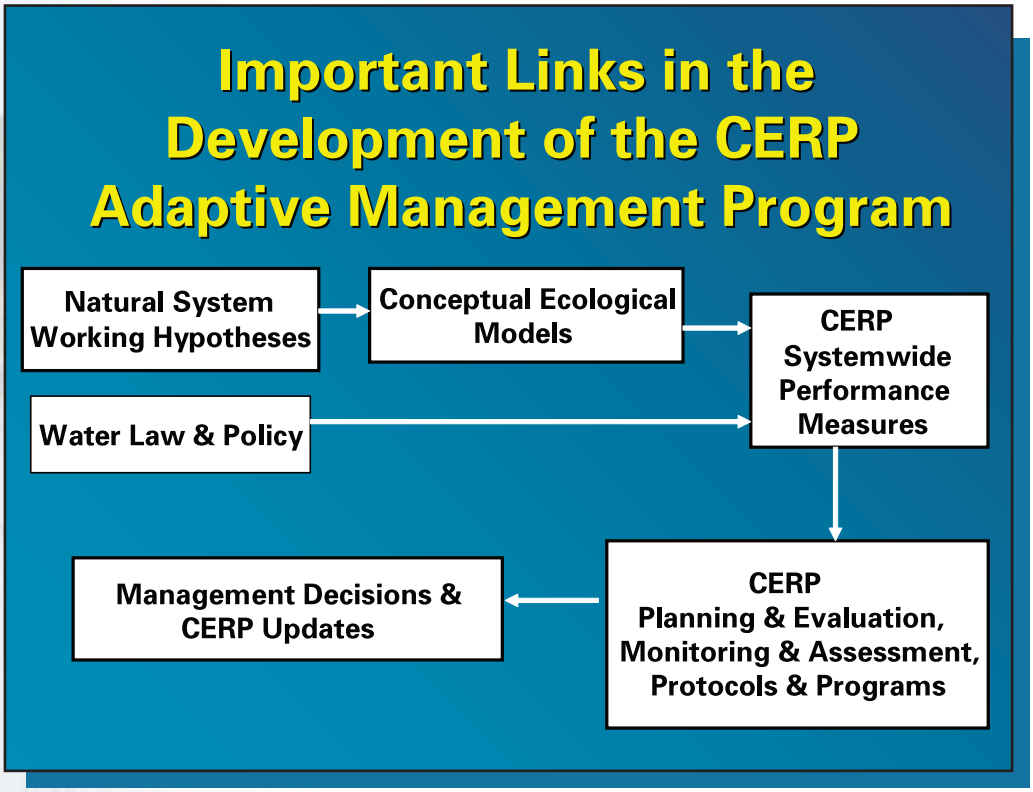
A total system conceptual ecological model (Total System Model) has been created as a planning tool for selecting the most appropriate set of performance measures for the CERP. This model looks at the bigger picture, picking up where the regional models leave off. It has been developed to evaluate the interactions among sub-regional conceptual models for CERP (e.g., Everglades Ridge & Slough, Southern Marl Prairies) and the upstream and downstream effects of what happens across boundaries.

Wading bird nesting patterns are a key indicator for measuring restoration success

Several Projects Currently Being Undertaken by RECOVER Track CERP's Performance

Development of the RECOVER Monitoring and Assessment Plan (MAP) has continued, and the draft plan was released in March 2003. This plan establishes the framework for measuring systemwide responses and for assessing how well the CERP is meeting its goals and objectives. As part of this process, monitoring and assessment performance measures and a process for establishing CERP's interim goals for ecosystem restoration have been developed. The plan merges existing monitoring programs with the information needs contemplated by CERP into a regional plan for data gathering. The plan will require continuous refinement and optimization to meet changing demands and resource constraints.

To provide the public and state legislators with an indication of the CERP's performance, a CERP Annual Report Card is being developed. The report card will use a set of key indicators (for example, wading bird nesting patterns and water supply for South Florida) that are representative of environmental health for both natural



and human systems. The 2001 draft CERP Annual Report Card (Appendix 7B-2 of the *2003 Everglades Consolidated Report*) is the first report card for CERP's initial elements and covers baseline, or pre-CERP, conditions. Successive report cards will provide an indication of improvements or other changes resulting from CERP implementation.

Initial CERP Update Continues to Incorporate New Technical Information into the CERP Process

The Initial CERP Update is underway to incorporate information on environmental changes and new information gained since the release of the CERP Feasibility Report in 1999. The primary efforts linked to the Initial CERP Update are (1) incremental modeling of the CERP Master Implementation Schedule, (2) Aquifer Storage and Recovery (ASR) contingency planning, and (3) development of the pre-CERP baseline. This update will result in a clearer picture of CERP performance under revised planning conditions. This information also will be provided to the individual CERP project teams as they begin project-level formulation and evaluation.

CHAPTER 8A

Achieving Long-Term Water Quality Goals

Everglades Forever Act Programs Progress Toward Water Quality Goals

The South Florida Water Management District, the Florida Department of Environmental Protection, and other parties have made substantial progress toward reducing phosphorus levels discharged into the Everglades Protection Area. The combined performance of the regulatory program in the Everglades Agricultural Area (EAA) and of the Stormwater Treatment Areas (STAs) (part of the Everglades Construction Project), both mandated by the Everglades Forever Act, has exceeded expectations. Best Management Practices (BMPs) have performed better than their 25-percent load reduction target by yielding more than a 50-percent reduction in phosphorus loading from the EAA. As a result, these BMPs have reduced phosphorus loads entering the Everglades by more than 1,100 metric tons (additional details are provided in Chapter 3). Average phosphorus concentrations in outflows from the STAs have been about 40 parts per billion (ppb), below the 50-ppb target. As of May 1, 2003, the STAs have reduced phosphorus load to the Everglades by 340 metric tons (additional details are provided in Chapter 4A). As of the end of April 2003, the Everglades Agricultural Area's Best Management Practices and Stormwater Treatment Areas have removed more than 1,400 tons of phosphorus that otherwise would have entered the Everglades.

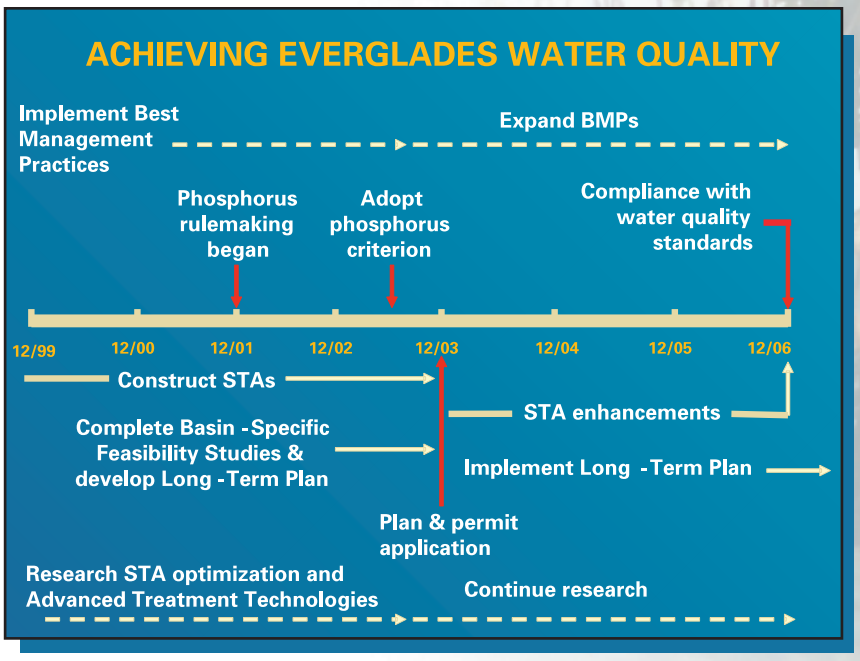
The Long-Term Plan for Achieving Water Quality Goals was Set in Motion by the State Legislature

Technical representatives of various agencies and other stakeholders used the results of the Basin-Specific Feasibility Studies, which were completed during the previous reporting period, to develop a "Long-Term Plan for Achieving Water Quality Goals." This important document was found by the state legislature to represent the best available phosphorus reduction technology for the Everglades. The 2003 Florida legislature amended the 1994 Everglades Forever Act to include implementation of the Long-Term Plan as the optimal strategy for achieving the phosphorus criterion in the Everglades Protection Area. The total estimated expenditures through Fiscal Year 2016 for full implementation of the Long-Term Plan are $444 million.

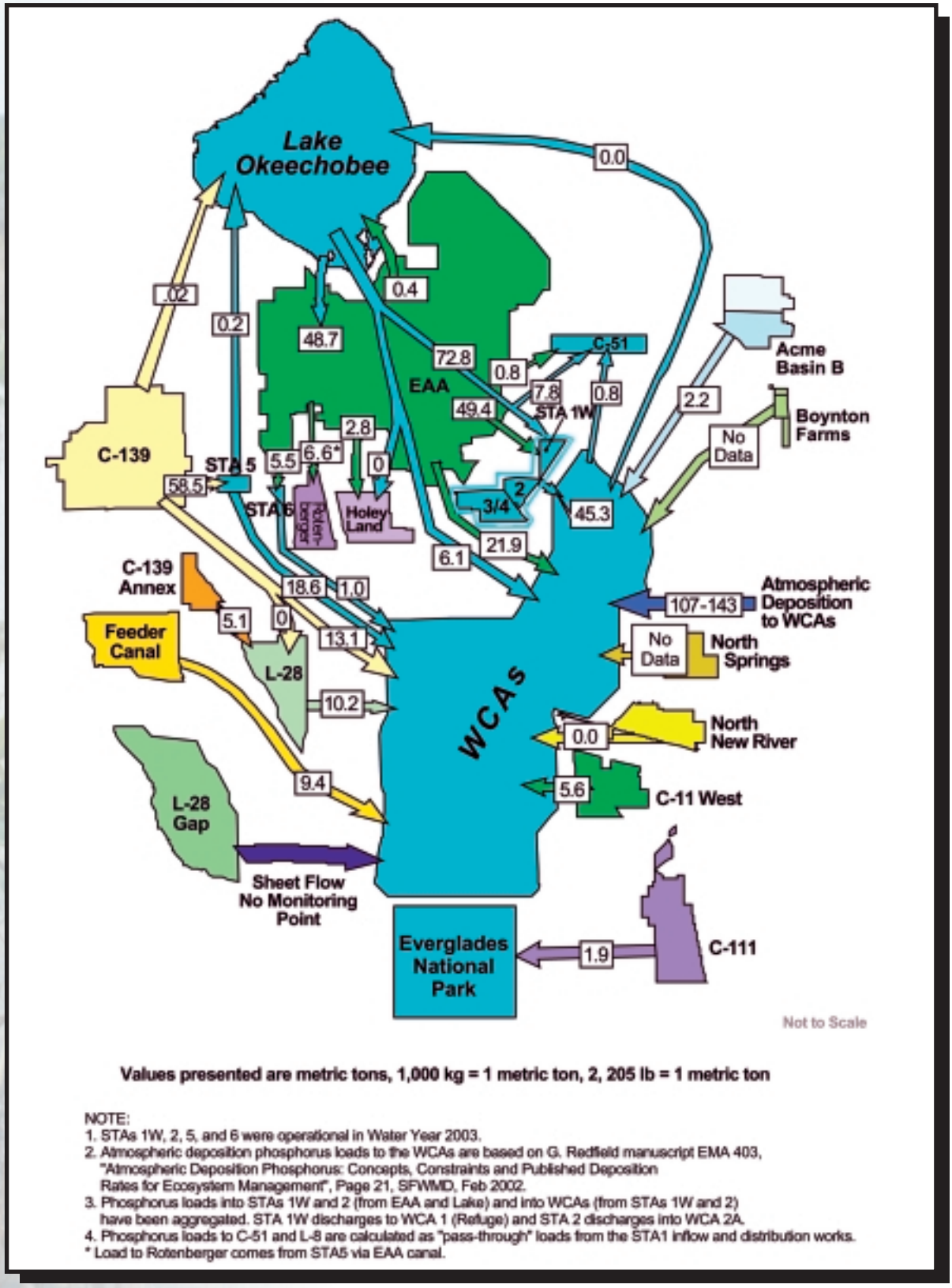
As shown in the figure on this page, many water quality improvement projects will be implemented from 2004 through 2006 to make structural and operational modifications to the STAs. These improvements may meet the legislative target of 10 ppb in the EPA. However, the Long-Term Plan has a strategy to optimize the performance of the water quality projects, integrate control programs with the Comprehensive Everglades Restoration Plan, improve source controls, and investigate ways to accelerate ecosystem recovery. Technical representatives involved in the development of the Long-Term Plan view it as the most aggressive and scientifically defensible approach to achieving goals of the Everglades Forever Act.

The Everglades Protection Area Receives Phosphorus Loading from Multiple Sources

The illustration on the following page provides information on the pathways of phosphorus to the Everglades Protection Area for Water Year 2003, the reporting period May 1, 2002 through April 30, 2003. In addition to substantial atmospheric inputs, phosphorus is conveyed through surface water inflows regulated by water control structures. These inflows are from agricultural areas to the north and west, from Lake Okeechobee to the north, and from predominantly urbanized areas to the east. Surface water inflows and loads vary from year to year in response to water management operational decisions and hydrological conditions. This depiction of phosphorus loading communicates both the magnitude and the diversity of pathways and also illustrates the importance of controlling phosphorus loads from the various sources.



Phosphorus Loads Conveyed into the Everglades Protection Area



Values presented are metric tons, 1,000 kg = 1 metric ton, 2, 205 lb = 1 metric ton

NOTE:
1. STAs 1W, 2, 5, and 6 were operational in Water Year 2003.
2. Atmospheric deposition phosphorus loads to the WCAs are based on G. Redfield manuscript EMA 403, "Atmospheric Deposition Phosphorus: Concepts, Constraints and Published Deposition Rates for Ecosystem Management", Page 21, SFWMD, Feb 2002.
3. Phosphorus loads into STAs 1W and 2 (from EAA and Lake) and into WCAs (from STAs 1W and 2) have been aggregated. STA 1W discharges to WCA 1 (Refuge) and STA 2 discharges into WCA 2A.
4. Phosphorus loads to C-51 and L-8 are calculated as "pass-through" loads from the STA1 inflow and distribution works.

* Load to Rotenberger comes from STA5 via EAA canal.

CHAPTER 8B

The Everglades Stormwater Program

The Everglades Stormwater Program (ESP) is responsible for administering the non-Everglades Construction Project (non-ECP) permit for eight tributary basins outside of the Everglades Construction Project. Through its 10-step Regulatory Action Strategy, this program also includes the development and implementation of strategies for achieving compliance with state water quality standards at non-ECP structures discharging into the Everglades Protection Area (EPA).

The District continues to make progress under this program to achieve the goals of the Everglades Forever Act, the non-ECP permit, and a future long-term compliance permit. The District also continues to work cooperatively with stakeholders to perform ongoing water quality sampling, establish cooperative agreements for water quality monitoring and improvement programs, identify potential "hot spots,"and implement Best Management Practices (BMPs) through cost share incentive programs for various basins. Chapter 8B of the *2004 Everglades Consolidated Report* provides an update on the status and progress of implementing the various elements of the Everglades Stormwater Program, as well as the basin-specific activities associated with this program.

The S-175 water control structure, part of the Everglades Stormwater Program

Water Quality Monitoring Programs Continue to Support Compliance with Non-ECP Permit Requirements

Water quality data from non-ECP structures during Water Year 2003 (May 1, 2002 through April 30, 2003), the sixth year of non-ECP data, were evaluated against state water quality standards. These comparisons fulfill non-ECP permit requirements to document the accuracy of the collected data and to measure progress toward achieving compliance with state water quality standards. Data evaluation indicates that there are very few excursions from Class III water quality standards found in surface water samples from non-ECP structures, except for dissolved oxygen and phosphorus. Analysis of phosphorus concentrations revealed significant basinwide differences, ranging from the lowest levels at the C-111 basin to the highest levels at the Boynton Farms basin. These findings indicate that although most basins continue to reflect low to moderate phosphorus levels, concentrations greater than 10 parts per billion in most basins will require further management activities.

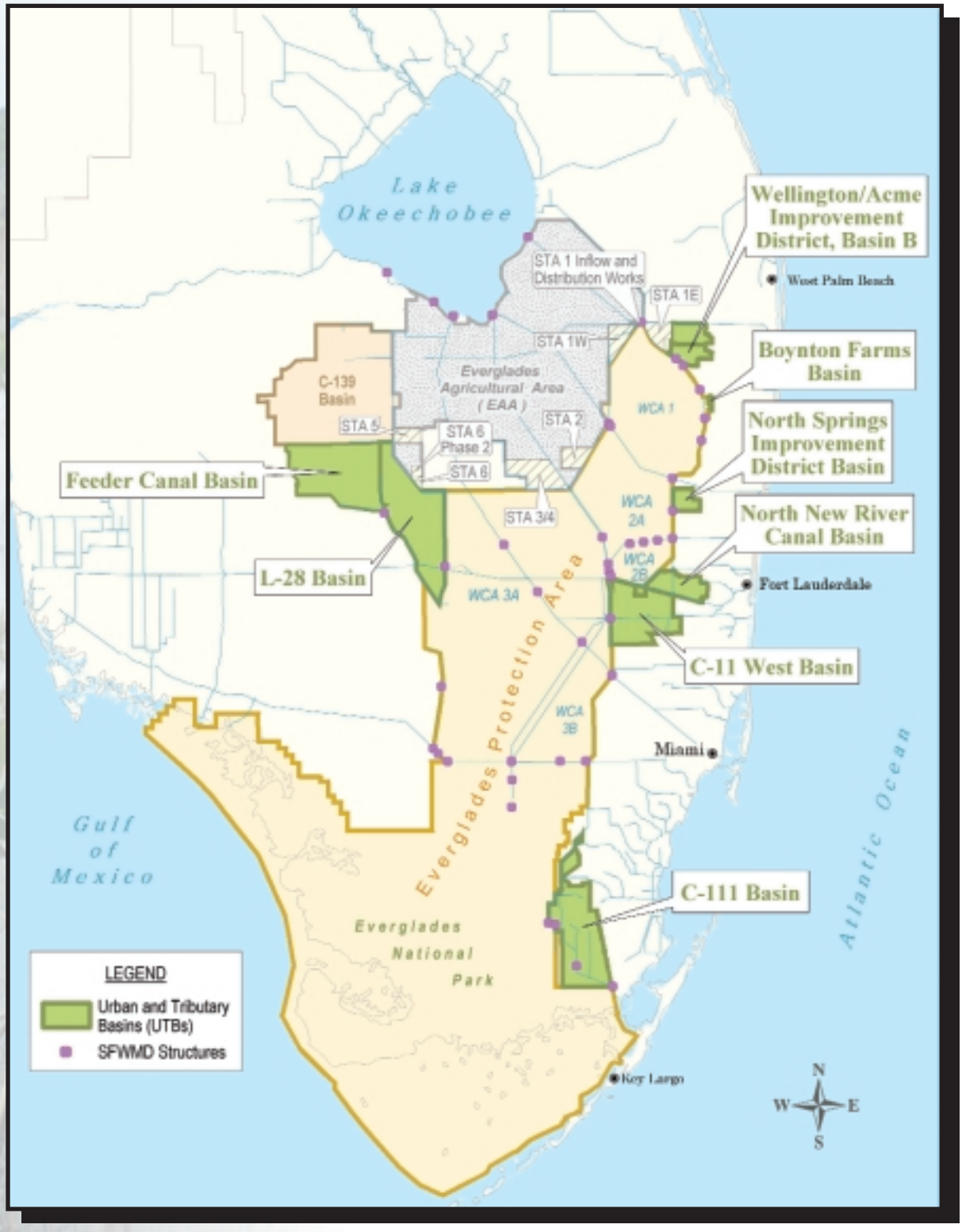
Water Quality Improvement Plans Will Aid in Achieving Long-Term Water Quality Goals for the Everglades

In October 2002, the District completed basin-specific feasibility studies for tributary basins discharging into the EPA. The activities associated with this study include six non-ECP basins and all basins associated with the Everglades Construction Project. The goal of these studies is to provide analyses of the various alternatives available for each basin to help identify the best combination of Best Management Practices, optimized Stormwater Treatment Areas, and Advanced Treatment Technologies necessary to meet the final water quality and water quantity objectives for the benefit of the Everglades. As discussed in the previous section (Chapter 8A, Achieving Long-Term Water Quality Goals), the District has developed a conceptual plan for achieving long-term water quality goals in the EPA using the information provided in the feasibility studies.

Public Involvement in ESP Basin-Related Issues Continues to Expand

The District has prepared a draft Public Outreach Plan, which applies to all ESP basins and includes both new components and enhancements to the existing public outreach initiatives being implemented in the C-11 West basin. The plan also coordinates public outreach initiatives being conducted by other District departments and governmental agencies to maximize resources and target audiences. The District is currently working with basin stakeholders in Broward County to develop countywide and industry-specific BMPs (e.g., nursery, equine, turfgrass and landscape). The "Freddy's Friends" club was reestablished at two elementary schools in the Central Broward Water Control District. Through the club's efforts, educational presentations related to the C-11 West canal and its water quality reached over 2,000 local elementary school students during this reporting period.

Everglades Stormwater Program Locations



CHAPTER 8C

Land Acquisition in Support of Projects in the Everglades Region

Over 13,000 Acres of Land Purchased During Water Year 2003 Support Water Resource Management Efforts

A critical component of restoring the Everglades is land acquisition necessary for water resource management. The District continues to aggressively acquire lands in support of water resources projects and programs throughout the region. The District's land acquisition strategy prioritizes the purchase of land based on construction schedules, willingness of landowners to sell, land threatened by potential development, and land in areas of rapidly escalating property values. During Water Year 2003 (WY2003), the reporting period from May 1, 2002 through April 30, 2003, the District successfully acquired 13,165 acres of land to be used for reservoirs and Stormwater Treatment Areas and to improve the South Florida region's flood control system, drainage, and water supply. A summary of the land acquisitions by project or geographic region during WY2003 is presented in the table below. The District's successful land acquisitions were possible only with the support of and through coordination with local, state, and federal agencies and in cooperation with the general public.

Several Major Acquisitions Accomplished in Water Year 2003 Increase District Land Holdings for CERP and Save Our Rivers Projects

The majority of the land acquired in WY2003 will address land requirements of the Comprehensive Everglades Restoration Plan (CERP). Slightly less than 92 percent, or 12,057 acres, of the lands acquired in WY2003 are designated for use by CERP projects. The remaining 1,108 acres, or 8 percent of the lands acquired within the Everglades region, contribute to the total District Save Our Rivers (SOR) lands that are not associated with a CERP project.

Lands acquired for CERP will be used to provide enhanced water quality, quantity, timing, and distribution. The 12,057 acres acquired in WY2003 increased the total lands available for use by CERP projects to 192,627 acres, representing 48 percent of the estimated land needed for CERP projects. The remaining acres acquired in WY2003 were located within SOR projects. These non-CERP acquisitions included the purchase of 771 acres within the East Coast Buffer, Water Preserve Areas, and 337 acres within the Water Conservation Areas.

CLOSINGS MAY 1, 2002 THROUGH APRIL 30, 2003

CERP PROJECTS	LAND AREA (ACRES)
Indian River Lagoon - South (7) C-23 North Reservoir, C-23 South Reservoir, and Allapattah Complex	9,342
North Palm Beach County - Part 1 (17) C-51 and L-8 Reservoir	1,220
Palm Beach County Agriculture Reserve Reservoir - Part 1 (20)	571
Central Lake Belt Storage - Part 1 (26)	28
Biscayne Bay Coastal Wetland (28)	101
Bird Drive Recharge Area (43), Deep and Shallow Water	418
Broward County Water Preserve Areas (45), C-11 Impoundment, C-9 Impoundment, and WCA-3A/3B Levee Seepage Management	253
WPA Conveyance (49)	126
ACRES (PERCENT) OF LAND ACQUIRED DURING WY2003 FOR USE BY CERP PROJECTS	12,057 (91.6%)
SOR PROJECTS	**LAND AREA (ACRES)**
East Coast Buffer, Water Reserve Areas Marshes, reservoirs, and groundwater recharge areas that abut East Coast protective levee	771
Water Conservation Areas Part of the original Central and Southern Florida Flood Control project	337
ACRES (PERCENT) OF LAND ACQUIRED DURING WY2003 FOR SOR PROJECTS	1,108 (8.4%)
TOTAL ACRES (PERCENT) ACQUIRED DURING WY2003	13,165 (100%)

CHAPTER 8D

Managing Fiscal Resources

The District is required to provide detailed financial information on Everglades restoration. The 1997 Everglades Oversight Act requires the reporting of financial information for the Everglades Construction Project (ECP). The 1994 Everglades Forever Act (EFA) requires the District to annually provide a comparison of actual versus projected revenues and a projection of costs and revenues over the succeeding five-year period. The EFA directs the District to separately account for all monies used to fund the 1994 Everglades Construction Project.

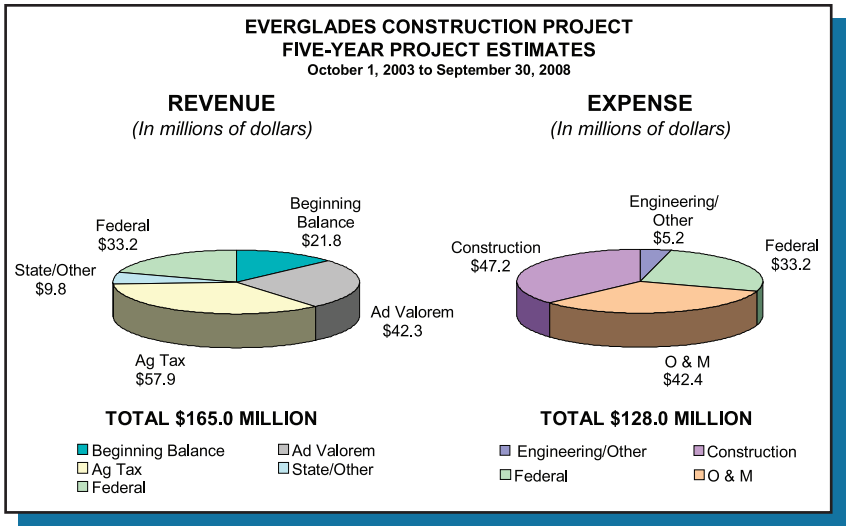
A dedicated funding source is essential to conducting Everglades and Florida Bay protection and restoration programs. The Everglades Construction Project, a major element of the Everglades Restoration Program, is one of the nation's largest public works projects for environmental restoration, estimated to cost approximately $836.2 million over 20 years. Florida Bay Restoration Program activities are ongoing, with a projected cost estimate of approximately $367 million. In 1996, the District and the Florida Department of Transportation (FDOT) received federal authorization to redirect the use of Alligator Alley tolls for both of these projects. Since 1997, a total of $12,125,000 has been received from the FDOT during FY1998 through FY2003 (as of September 30, 2003), which has been split equally between both projects.

Funds Support Everglades Construction Projects

The total cost associated with implementing the 1994 ECP is shared among the District, other state and federal agencies, and the agricultural community. Funding sources designated by the EFA for the 1994 ECP included 1/10 mill *ad valorem* tax, agricultural privilege taxes, state land funds, federal funds, excess revenues from Alligator Alley tolls, other environmental mitigation funds, and any additional funds that become available for this purpose from any other source. Since 1994, actual revenues received are $494.4 million compared to original projections of $481.7 million.

Since the enactment of the 1994 EFA, 1/10 mill of the District's Okeechobee basin millage has been dedicated to the 1994 ECP. The District has the authority to levy *ad valorem* taxes of up to 1/10 mill within the Okeechobee basin for land acquisition, design, and construction of the Everglades Construction Project. For Fiscal Year 2003 (FY2003), net *ad valorem* tax revenues were approximately $38.7 million (unaudited) through September 30, 2003. The 1/10 mill *ad valorem* tax, net of tax collection cost, is currently estimated to generate approximately $42.3 million in FY2004.

To fund the first phase of the Everglades Restoration Program, the EFA imposes an annual tax for the privilege of conducting an agricultural trade or business within the Everglades Agricultural Area (EAA) and C-139 basins. The agricultural privilege tax rate ranges from a minimum of $24.89 per acre from November 1994 to November 1997, to a potential maximum of $35 per acre from November 2006 to November 2013. In FY2003, the net EAA agricultural privilege taxes collected were approximately $12.0 million (unaudited) through September 30, 2003. During this reporting period, the net C-139 basin agricultural privilege taxes collected were $576,812 (unaudited) through September 30, 2003.



Additional Funding Secured for Everglades Restoration Efforts

Since the publication of the *2003 Everglades Consolidated Report*, there have been two significant events regarding Everglades restoration, cleanup, and water quality improvement: amendments made to the existing EFA by the Florida Legislature, and the Florida Department of Environmental Protection Environmental Regulation Commission's approval of a numeric water quality standard for total phosphorus. The 2003 Florida legislative session amended the 1994 EFA (Section 373.4592, Florida Statutes) to expand use of the 1/10 mill *ad valorem* tax, associated with design, construction, and implementation of the initial phase of the Long-Term Plan for Achieving Water Quality Goals, including Stormwater Treatment Area enhancements, and operation and maintenance of the Everglades Construction Project. It is currently projected that the Long-Term Plan's initial 13-year phase will cost approximately $443.9 million.

CHAPTER 8E

Exotic Species in the Everglades Protection Area

Exotic species are plants or animals that are not naturally found in a region. They can aggressively invade habitats and cause multiple ecological changes, including the displacement of native species. Invasive exotic species have become one of our most serious and global environmental problems. In the United States alone, these "exotics" – plants, mammals, birds, amphibians, reptiles, arthropods, and mollusks – are estimated to cost more than $100 billion every year in damages and associated controls. The impact is more than just economic. Invasive plants have ecologically affected more than 200 native U.S. plant and animal species, forcing them into threatened or endangered status.

Florida is not exempt from the impact of invasive exotics. In fact, the state is one of four (with Hawaii, California, and Louisiana) harboring the greatest number of nonindigenous plants and animals. As a region, South Florida contains more introduced animals than any other area in the United States. Research shows that 26 percent of all resident vertebrates are nonnatives, giving South Florida the unfortunate distinction as home to one of the largest, nonindigenous faunal communities in the world.

Lygodium *infestation of a tree island in Water Conservation Area 1*

Programs Help to Control Invasive Exotic Species

The significance of exotic species in environmental management of South Florida is demonstrated by the numerous reports, statements, and plans presented on this subject during the past two decades. Scientific research continues to support the fact that invasive, nonnative plants and animals in Florida have taken an aggressive hold in valued ecosystems, including the Everglades Protection Area (EPA).

The 1994 Everglades Forever Act called for the District to monitor invasive species programs in the EPA and to coordinate with other governmental agencies in finding ways to manage exotic pests. The South Florida Ecosystem Restoration Task Force has responded to this mandate. A Noxious Exotic Weed Task Team (NEWTT) was formed in 1997 to focus on nonindigenous plants, assess current problems, prioritize individual species for control efforts, and coordinate agencies managing exotic plants.

The effort to manage exotic animals in Florida is not as well coordinated. In response to this, the task force established the Noxious Exotic Animal Task Team (NEATT) in 2003. This interagency group is currently developing a comprehensive report to provide a broad picture of nonindigenous animals in South Florida and to help prioritize the efforts of various agencies. More than 20 species have been identified as "of greatest concern" to the region. Representing all major animal groups, these invasive species include insects, crustaceans, mollusks, marine and freshwater fish, reptiles, amphibians, birds, and mammals. Unfortunately, the impact of nonindigenous animals on native plant communities and indigenous animal populations is not easily assessed.

Fortunately, the Comprehensive Everglades Restoration Plan (CERP) is beginning to address the issue of invasive exotics. A conceptual plan was authorized in 2002 for a multimillion-dollar Invasive Species Management and Control project, sponsored locally by the District. This project includes cost-share agreements to improve in the research, quarantine, and release of biological control agents and a report to detail potential federal participation in South Florida's invasive species programs.

Management Efforts for Exotic Plants

Since 1990, the District has been closely coordinating with other agencies all vegetation management efforts within the Everglades Protection Area. Detailed, species-based management plans have been developed for melaleuca (*Melaleuca quinquenervia*), Brazilian pepper (*Schinus terebinthifolius*), and Old World climbing fern (*Lygodium microphyllum*). These plans are now serving as models for future species-specific plans.

A variety of techniques have proven effective in controlling exotic plants in the Everglades Protection Area. Herbicides, as approved by the U.S. Environmental

Protection Agency, are an important tool for this effort. In 2003, a "special local needs" label was approved for Escort® herbicide for government agencies to treat *Lygodium* in wetlands. In addition, biological agents, manual and mechanical controls, and management practices (such as prescribed burning and water-level manipulation) are also used – separately or in combination – to slow the spread of invasive plants. Each of these methods has its advantages and is used when and where it can have the most impact.

Vegetation managers are finding that biological control offers the most cost-effective, long-term management approach for widespread invasive weeds. *Melaleuca* snout beetles, first released in 1997, feed on new leaf growth at branch tips of invasive *Melaleuca*. An 80-percent reduction in flowering was observed among damaged *Melaleuca* trees as compared to a similar undamaged group. As of August 2003, more than 18,000 larvae and 210,000 adults have been released at 150 different locations in 12 counties. A second *Melaleuca* biocontrol insect, *Boreioglycaspis melaleucae*, was released from quarantine in February 2002. Preliminary data show that attack by this sap-sucking psyllid has produced a 60-percent mortality rate among *Melaleuca* seedlings.

Isolating, testing, and releasing a host-specific insect to control one invasive exotic plant in the United States can take more than a decade. Entomologists studying the *Melaleuca* problem estimate that four to five insect species will be required to effectively suppress this plant's invasive capacities. In the end, no one method will be the final answer to management of all invasive plants. Improved integration of weed-control techniques will be needed to optimize the effectiveness of each method.

Where to Go Next?

The task of controlling nonindigenous species – both plant and animal – cannot be dealt with by a single method, discipline, or agency. All agencies involved in ecosystem management in South Florida must make a commitment to support this work with staff and finances. Invasive exotic species will always require some level of maintenance, and new introductions will need to be curbed in order to avoid future costs.

Additional information is urgently needed on the identification and distribution of nonindigenous species, potential biological controls, integrated pest management practices, and the effects of water-level fluctuations on the spread of invasives. At the same time, agencies must continue to fund ongoing management programs, promote statewide agency coordination, develop comprehensive management authorities and regulations, and develop public/private partnerships. For the District, control of exotic species is a necessary component of responsible water resource management and an investment in the success of South Florida's ecosystem restoration.

Water lettuce and hydrilla collect at water control structure S-235

CHAPTER 8F

The Lower East Coast Regional Water Supply Plan

The Lower East Coast Regional Water Supply Plan (LEC Plan) provides a blueprint to help meet South Florida's water resource needs through the year 2020. By 2020, South Florida's population is projected to increase from 5 million to 7 million residents, with most people living along the coast. This growth will create increasingly larger demands for both potable and irrigation water. In addition, environmental demands call for significant increases in water deliveries to sustain and restore South Florida's water resource-dependent natural systems. The District's governing board adopted the LEC Plan in May 2000.

Canoeists on the northwest fork of the Loxahatchee River

Projects identified by the LEC Plan continue to be implemented. These projects complement the Comprehensive Everglades Restoration Plan by increasing the amount of water available for urban users and for agriculture as well as for the Everglades and other natural systems. The LEC Plan includes additional water resource and water supply projects, related studies, and rule development for minimum flows and levels and consumptive use permitting.

New Rules for Water Levels and Water-Use Permits Adopted this Year

LEC Plan highlights during the past year include adoption of Minimum Flows and Levels rules for both the St. Lucie Estuary (December 2002) and the northwest fork of the Loxahatchee River (February 2003). These rules help to protect the water resources and ecology associated with these bodies of water.

Water-use permitting rules were adopted in 2003 that address permit duration and renewal, supplemental irrigation requirements, pollution remediation, reuse of reclaimed water, aquifer storage and recovery, wetland protection, and interference with existing legal uses, among other topics.

Construction began in April 2003 of the G-160 Loxahatchee Slough structure. This structure is part of the initial phase of the Northern Palm Beach County Comprehensive Water Management Plan. Also in Palm Beach County, construction was completed of the Hillsboro Aquifer Storage and Recovery (ASR) facility, which was partially funded by the District.

Two mobile irrigation laboratories now serve the Lower East Coast. In the past year, they evaluated 243 irrigation systems, identifying and solving problems – and creating an estimated annual savings of 410 million gallons. Funding for a third mobile laboratory was approved by the District's governing board to serve Broward County, and start-up activities have been initiated.

In 2003, three new water conservation projects were selected for implementation, continuing partnerships with Palm Beach, Broward, Miami-Dade, and Monroe counties. These projects will save 173,000 gallons of water per day.

Under the Alternative Water Supply Grant Program, 30 projects Districtwide were recommended for funding, totaling $4.5 million. Seventeen of the projects are located within the LEC region and, when completed, will produce more than 54 million gallons per day of additional supply.

District staff participate in "Take Your Child to Work Day" at the groundbreaking for the G-160 Loxahatchee Slough structure

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Glossary

Adaptive management: The application of scientific information and explicit feedback mechanisms to refine and improve future management decisions.

Best Management Practices (BMPs): Land, industrial, and waste management techniques that reduce pollutant export from a specified area.

Bioaccumulation: An increase in concentration of a contaminant in an organism, relative to its concentration in the environment over time.

Compliance monitoring: In a water quality management program, compliance is associated with meeting permit conditions as well as ambient standards. Ongoing monitoring provides periodic water quality data, which are used to assess compliance.

Everglades Forever Act (EFA): A 1994 Florida law (Section 373.4592, Florida Statutes), amended in 2003, to promote Everglades restoration and protection. This will be achieved through comprehensive and innovative solutions to issues of water quality, water quantity, hydroperiod, and invasion of exotic species to the Everglades ecosystem.

Everglades Protection Area (EPA): As defined in the Everglades Forever Act, the EPA is comprised of Water Conservation Areas 1, 2A, 2B, 3A, and 3B, the Arthur R. Marshall Loxahatchee National Wildlife Refuge, and the Everglades National Park.

Flow-weighted mean concentration: The average concentration of a substance in water, corrected for the volume of water flow at the time of sampling. Samples taken when flow is high are given greater weight in the average.

Geometric mean: A statistical average of a set of numbers, often used to represent a central tendency in highly variable data, such as water quality. It is calculated from data transformed using powers or logarithms and then transformed back to original scale.

Loading (or mass loading): The amount of material carried by water into a specified area, expressed as mass per unit of time. One example is phosphorus loading into Water Conservation Area 2A, measured in metric tons per year.

Minimum Flows and Levels: Florida law (Chapter 373, Florida Statutes) requires the state's water management districts to set water levels for each major body of water "…at which further withdrawals would be significantly harmful to the water resources or ecology of the area."

Parts per billion (ppb): A unit of measure, equivalent to micrograms per liter (1 ppb = 1 μg/L).

Periphyton: The biological community of microscopic plants and animals attached to surfaces in aquatic environments. Algae are the primary component in these assemblages, which naturally reduce phosphorus levels in water and serve a key function in Stormwater Treatment Areas.

Phosphorus: An element that is essential for life. In freshwater aquatic environments, phosphorus is often in short supply; increased levels can promote the growth of algae and other plants.

Scientifically defensible: Information that is supportable using accepted scientific methods of data collection, analysis, and reporting.

Stormwater Treatment Area (STA): A large, constructed wetland designed to remove pollutants from stormwater runoff.

Water quality (WQ) criteria: Constituent concentrations based on scientific data and judgments on the relationship between pollutant concentrations and environmental and human health effects.

Water quality standards (WQS): State-mandated water quality standards that are comprised of the beneficial use classification, the water quality criteria applicable to that classification, the Florida antidegradation policy, and several provisions in other rules.

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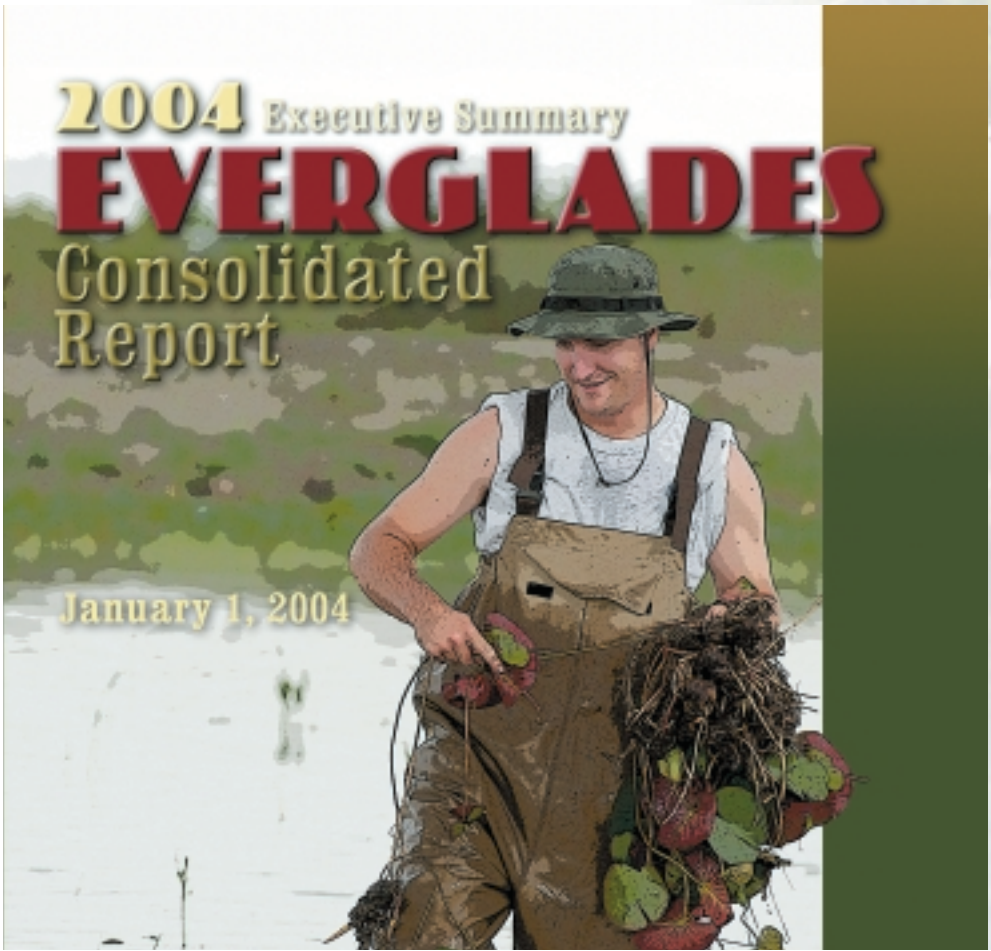
The *2004 Everglades Consolidated Report* is also available on the World Wide Web at this URL: www.sfwmd.gov/org/ema/everglades

On the cover: District employee Jonathan Huels plants fragrant water lily (*Nymphaea odorata*) to colonize slough habitats in the Loxahatchee Impoundment Landscape Assessment (LILA) project. Photo by Patrick Lynch, SFWMD.



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